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Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

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Western Activity. SOME idea of the activity prevailing in electrical circles in the West may be inferred from the item in our Western Notes showing that a young Chicago firm, making a specialty of steam installations for electrical stations, secured in the first week of its organization, contracts for over 2,600 h. p. in engines alone, divided among several stations.

The Frund Lighting Tables. AN important saving to municipalities, and to companies doing public electric lighting, will result, we believe, from the adoption of the moonlight schedules of which the first, for the month of July, is given in our columns this week. Mr. Frund's ingenious tables result in lighting as satisfactory, for all practical purposes, as the all-night system, and immeasurably superior to the ordinary moonlight timing; while the number of lamp-hours required is very much less than if the lamps burned all night, being, in fact, little more than those of the Philadelphia schedule.

The Exhibit at Minneapolis. WE are pleased to give to our readers this week some little account of the new and beautiful lighting effects that will be used in the coming exhibition at Minneapolis. They are due, like the artistic arrangement of the Lenox Lyceum exhibit, to the ingenuity and skill of Mr. Luther Stieringer, who has become known as a master of effective electrical lighting. The designs for Minneapolis are certainly novel and striking, and can hardly fail to reflect great credit on the designer, and show in a very striking manner the æsthetic as well as the useful side of electric lighting.

The Growth of City Lighting. AN interesting report appears in our columns showing in detail the growth of the various methods of lighting in the city of Paris during the past 35 years. The notable fact shown by it is the enormous increase in the use of electricity. With all the additions to commerce and industry that have taken place in the last decade, the proportional amount of gas used remains but little larger than 10 years ago, while two-thirds of the total increase in the lighting of that great metropolis is due to the accession to power of the arc and incandescent systems. Such is the lesson that these few years have taught, and it is evident enough that the future will show figures that will make these seem commonplace. Electric lighting has come to stay, to grow, to drive mediæval methods into well-merited oblivion.

Explosions in City Streets. WE avoided last week attributing to the Steam Heating Company its due share of blame for the explosion at Fulton street; for at that time it was not certain, as it now is, who was mainly responsible for the accident. It was gas, to be sure, that exploded and burned; but it was the inexcusable carelessness of the steam company that increased the customary leakage to an amount large enough to produce an unusually severe blow-up. Since that time this little by-play of wrecking streets and houses has been thrice repeated, and condemnation of the company indulging in it is becoming very severe. When, for instance, has any company engaged in transmitting *electrical* energy been the subject of an official report recommending, in certain contingencies, that "steps be taken for the revocation of the company's franchise on the ground that its business, as now conducted, is a common nuisance, prejudicial to public health, destructive to property and actually dangerous to life"?

Electroplating with Platinum. OF all available metals platinum stands alone, uniting in itself immensely valuable properties, that were the metal more easily workable would make it indispensable in a wide range of arts. It is more nearly indestructible than any other element with the possible exception of iridium, possesses a good color, takes a fine polish and is wonderfully ductile. Many attempts have been made to apply it to the plating of baser metals, and while some degree of success has been reached, the process is so difficult as to limit its application to small articles like the scale pans of fine balances. Were it easier, there would be great possibilities for its use in chemical and mechanical industries. Mr. Wahl's valuable paper published in the present issue is the result of a great amount of careful experimenting, and he seems to have evolved a series of processes that are likely to prove of no small commercial importance. When a regular, dense, smooth deposit of platinum can be obtained it at once becomes possible to apply it to all sorts of metal articles that need elaborate protection against corrosion. It may even be practicable to platinum plate the great sulphuric acid stills, and so effect a very large saving in the cost of the plant. It is to be hoped that Mr. Wahl's research will prove the beginning of a very useful development in the art of electroplating.

Electricity in Railway Service. THERE is much of interest in the report of the Association of Railway Telegraph Superintendents published in our columns this week. Few people realize to what an immense extent electrical appliances have come into use to facilitate and render safe the operation of complicated railway systems. It is not very many years ago when the telegraph was looked upon by railway managers with distrust; but with the enormous growth of railway industries it soon became clear that an attempt to run frequent trains without some means of communicating between distant points must result in failure and disaster; and the telegraph, once pressed into the service, has gone on developing into all sorts of electrical devices to make railroading easy and secure. Mr. Stewart's paper on the history and development of the block system is replete with suggestive possibilities of still more elaborate applications of electricity. The next paper, read by Mr. Selden, will be of even greater interest to our electrical readers, for it dealt with the possible use of electricity for increasing the adhesion between the wheels of a locomotive and the track by the method suggested in Mr. Ries' paper. (See THE ELECTRICAL WORLD, June 7, 1890.) His thorough and studious discussion of the problem was received with great interest on the part of the expert railroad men who make up the association, and the experiments that were tried, demonstrating the existence of the adhesive action, were of a very convincing character, so far as experiments and models could be. Subsequent discussions dealt with the use of electric lights to facilitate clearing away wreckage, its further application for electric service, and the system of train despatching. Many well known electrical companies were represented at the meeting by exhibits, and the character of all the papers and discussions is a striking evidence of the quickness of American railroads to appreciate the advantages of electrical apparatus.

The Path of Progress. In closing the fifteenth volume of THE ELECTRICAL WORLD it is fitting that something be said to its readers of the advances accomplished during the past six months, as well as of the line of progress that has been laid out for the paper during the coming half-year. The volume just concluded has shown the same regular and flattering growth that has characterized the history of the paper for the past five years. This growth has been uninterrupted. Nothing has interfered with its steady and healthy advance, and whether one turns to the reading matter, to the advertisements, or to the subscriptions, in every department is to be found an improvement as compared with a year ago. The readers of this volume have had placed before them more than 440 pages of matter, as against only 380 for the corresponding period last year. Every line of this has had its fair share of interest, and has been valued by the reader; for every line of it has been the honest expression of unbiased and impartial thought. This fund of information has been illustrated in a manner not attempted by other periodicals—exhaustively, accurately and artistically. It has been gathered by a staff of over fifty persons—a staff larger than that of many daily newspapers. As a gazette of the electrical trades, too, THE ELECTRICAL WORLD is fast advancing. Its advertising pages, now usually numbering forty or more each week, contain the cards, large and small, of almost every important business house connected in any way with the electrical and allied interests. Its weekly index of advertisers, in fact, is little less than a directory of the electricians and electrical promoters of America. No important firm or corporation has found that it can afford long to be omitted from that list, and the new names constantly added to it almost always come to stay. To this is due the fact that most of our readers scan our advertising pages as carefully as they would the reading matter of many another journal. Turning to the future, it is almost unnecessary to say that everything will be done that can be done to make THE ELECTRICAL WORLD as complete, as accurate, as able, and as interesting as any industrial journal in the world. Untrammeled, as our journal is, by any alliances or entanglements with any electrical company or interests, it will continue to be, also, absolutely impartial and independent. On such a basis, with a worthy past and a successful present—successful beyond all expectation—we feel that we can promise to our readers a brilliant future.

A Chance for Electricity. THE decision in the case of the Third Avenue surface road, holding that it can, by application to the Railroad Commissioners, employ electricity on its lines in lieu of any of the methods laid down in its charter, is of great importance to electrical interests. It is now clear that surface roads which desire to utilize to the utmost the improvements that have been devised in methods of traction can do so without serious hindrance, and it is to be hoped that they will rapidly take advantage of the opportunities offered and give to the overburdened city as great rapid transit facilities as modern ingenuity can secure to roads that necessarily operate upon instead of under the streets. We trust, however, that the managers of these street car systems in deciding upon change in motive power will not be too hasty in the use of cables for the purpose. There is no doubt of the great usefulness of the cable as a factor in rapid transit, but it is open to objections which we think are serious enough to constitute formidable difficulties in the way of its use here in New York. Chief among these is the inflexibility of a cable system as regards speed, from which results unquestionable danger in crowded streets. So long as the track is clear cable cars proceed with admirable regularity and without any special danger of accidents; but when, as so often happens, the pavements are blocked with vehicles of all sorts, the use of the cable becomes somewhat perilous. It is exceedingly difficult to work through a crowded street without means of backing a car and without thoroughly successful arrangements for running at a very much reduced speed. It is in just these particulars that electric traction is advantageous, inasmuch as by it it becomes possible to start, stop or reverse the car with the greatest ease and security. Another characteristic disadvantage of the cable system is its inability to make up lost time. A cable car once delayed must stay delayed, while an electric car can very often make up a considerable amount of lost time by a somewhat increased speed in the open portions of the city. Again, if a cable breaks it is useless through its entire length, while it is of very rare occurrence that an electric system is crippled in any extensive way. The use of double cables will to a certain extent remedy this difficulty; but it is costly and somewhat inconvenient. The principal objection to the use of the cable, the enormous cost of the substructure, does not apply with so great weight in New York as elsewhere, because the traffic is sufficiently heavy to pay well, even on an exceedingly large investment. New York should profit by the experience of St. Paul, Minneapolis and Boston, and not be too hasty in committing itself permanently to methods of traction that will seem antiquated within a comparatively short time.

Moonlight Tables.

In The Electrical World of May 31 we mentioned the very ingenious compromise, devised by Mr. H. W. Frund, between the too-expensive all-night lighting and the unsatisfactory moonlight schedule. We give herewith Mr. Frund's lighting table in parallel with the schedule usually adopted for the month of July, 1890. We shall hereafter similarly print the tables for each month in our last issue of the month preceding. The main feature of the Frund tables is the use of the light until 12 o'clock every night, and after 12 only in the absence of moonlight; but in other respects the work is original. The accompanying tables are prepared for us by Mr. Frund, who states that since we noticed his system he has been besieged with requests for copies. The figures are good for the entire United States, and will not be published except in The Electrical World:

[*Schedule for July*, 1890.

TABLE NO. 1. Standard Moonlight. Philadelphia System.				TABLE NO. 2. Frund's New Moon light System.			
Date.	Light.	Date.	Extinguish	Date.	Light.	Date.	Exting.
1	No Light.	1	No Light.	1	8:00 P. M.	1	12:00 P. M.
2	" "	2	" "	2	8:00	2	12:00
3	" "	3	" "	3	8:00	3	12:00
4	8:00 P. M.	4	10:45 P. M.	4	8:00	4	12:00
5	8:00	5	11:25	5	8:00	5	12:00
6	8:00	6	12:00	6	8:00	6	12:00
7	8:00	8	12:25 A. M.	7	8:00	8	12:25 A. M.
8	8:00	9	12:55	8	8:00	9	12:55
9	8:00	10	1:20	9	8:00	10	1:20
10	8:00	11	1:50	10	8:00	11	1:50
11	8:00	12	2:20	11	8:00	12	2:20
12	8:00	13	2:55	12	8:00	13	2:55
13	7:55	14	3:45	13	7:55	14	3:45
14	7:55	15	3:45	14	7:55	15	3:45
15	7:55	16	3:45	15	7:55	16	3:45
16	7:55	17	3:45	16	7:55	17	3:45
17	7:55	18	3.45	17	7:55	18	3:45
18	7:55	19	3:45	18	7:55	19	3:45
19	7:55	20	3:50	19	7:55	20	3:50
20	7:55	21	3:50	20	7:55	21	3:50
21	9:15	22	3:50	21	7:55	22	3:50
22	9:40	23	3:50	22	7:55	23	3:50
23	10:00	24	3:50	23	7:55	24	3:50
24	10:30	25	3:50	24	7:55	25	3:50
25	11:00	26	3:50	25	7:55	26	3:50
26	11:30	27	3:55	26	7:55	27	3:55
27				27	7:50	28	3:55
28	12:10 A. M.	28	3:55	28	7:50	28	12:00 P. M.
29	1:00	29	3:55	29	7:50	29	12:00
30	No Light.	30	No Light.	30	7:50	30	12:00
31	" "	31	" "	31	7:50	31	12:00
Total hours lighting, 146.35.				Total hours lighting, 192.45.			

The Electrical Progress of a Half Year.

In reviewing the electrical advances of various kinds that have been made in the past six months, we find nothing revolutionary, no marvelous discoveries, no epoch-making inventions; but, instead, a swift and steady growth, in theory and practice, of our knowledge of electrical science and our command over electricity in the arts. If we look first at the eldest brother of the great electrical family of industries, the telegraph, we shall find nothing exceedingly new or of striking theoretical importance. All previous records of rapid work with the ordinary Morse instruments were broken in the Fast Telegraphers' Tournament by the phenomenal sending of Mr. Pollock at the rate of 52 words per minute (270).* Several other splendid records were made at the same time. Throughout the telegraphic world there has been a steady growth of lines and general business without any extraordinary features. Two instruments, too, are worthy of note, as embodying novel and valuable features—one, the remarkable page printing telegraph, which has been notably improved during the present year (287); the other, Patten's method of synchronous telegraphy, which has hardly yet, however, entered on its career. The tendency on the part of large telegraph offices to discard the use of batteries and employ specially-wound dynamos for generating currents has shown itself in the establishment and operation of several plants (173, 255). The dynamo in this rôle is an important improvement in telegraphic methods, inasmuch as there is an enormous saving of care and expense by its use. Across the water telegraphers are not so enterprising in the way just mentioned. The Postmaster-General's scheme (329) for a limited postal telegraph service has met a well deserved fate and probably will not be revived. Perhaps the most interesting addition to telegraphic methods that comes to us from our English brethren is embodied in the paper of Mr. W. F. Melhuish (315), who called attention to various clever methods of facilitating telegraph engineering under difficulties.

The telephone has had a similar career during the last few months. There has been growth and improvement everywhere, without any startling developments. Something of a novelty, however, is the report of quite successful experiments in Canada on duplex telephony (312).

In the great field of electric lighting there has been enormous progress from a commercial point of view, and more than a little has been done in the way of new apparatus and machinery. Reference to the correspondence column of The Electrical World in almost any week will show the marvelous activity displayed in spreading the electric light in every corner of the country. A novelty in electric lighting that promises to push its way rapidly into commercial importance is the Westinghouse alternating arc light system (220), which is the result of a vast deal of careful experimenting, and possesses the striking merit of very slow burning of the carbons. Another novel and ingenious arc lamp comes from our English friends—the Saunderson electric torch (386), which, unless reports are grossly exaggerated, possesses some striking merit. The meeting of the National Electric Light Association in February produced a number of valuable contributions to our knowledge of the methods of arc lighting in the paper of Mr. Law (143), dealing especially with the arc lamp and the ways in which to secure from it the most successful and efficient service, and the contributions of Mr. Lockwood (151) and Prof. Thomson (145) discussing with great detail that exceedingly important subject, the methods for securing safety in high-tension lighting. Especially was the paper of Prof. Thomson notable for its outspoken dealing with the question and repleteness of brilliant suggestions for improved service.

From the incandescent department there are marked signs of improvement all along the line. What has to be noted, perhaps, in connection with incandescent circuits is the arc lamp for use in systems of parallel distribution (256), which bids fair to fill an important place as an adjunct to incandescent stations. As regards the incandescent lamp itself, we may note with pleasure a series of numerous reports that show the improvements recently made in its manufacture. Several cases of extraordinary life of the glow lamp have been reported (299, 345).

At the May meeting of the Institute of Electrical Engineers special notice should be taken of two exceedingly practical papers dealing with electric lighting: Mr. Fleming's interesting account of the difficulties and peculiarities of electric light engineering in hot climates (369), and a most exhaustive study of the carbons used for arc lighting, by Mr. L. B. Marks (364). This latter paper is a valuable addition to our practical knowledge of a small but very important factor in commercial lighting. Mr. Marks specially discussed the relation of quality of carbon to the conditions under which it is to be used, a subject hitherto neglected in scientific investigation, and regarding which there had been only such knowledge as has been picked up here and there in the course of practical experience. So far as the chief instrument of electric lighting, the dynamo, is concerned, we may note several remarkable machines that have just been brought into action. First among them is the remarkable alternator used in the Westinghouse arc system previously mentioned and besides this accounts of two very striking machines have come to us from the continental electricians—one the Reignier-Bary dynamo (238), extraordinary for its enormous weight output, and for the very ingenious composite character of the conductors employed; the other (282), the Polechko disc dynamo, of even greater output than the one just mentioned in proportion to its weight, and especially interesting from a theoretical point of view, as it has been developed along the line of the Barlow wheel, which may, perhaps, be called the earliest electric motor, inasmuch as it was first described no less than 64 years ago. It is specially remarkable that at this late day the machine, which theoretically is of a most rudimentary character, should have been brought into practical commercial operation.

Of a more theoretical character, but intensely interesting to any practical electrician, is the paper of Dr. Duncan on the efficiency of alternating current apparatus, read before the American Institute of Electrical Engineers (242), which embodies the results of perhaps the only complete test of an alternating current system that has yet been made with anything approaching scientific exactness. Equally important is that very interesting discussion on dynamo and motor designing, by W. B. Esson, the well-known English electrician (213, 226, 243, 258), in which, for the first time, some of the minor but puzzling details of designing are thoroughly discussed. Of a no less practical character were the interesting notes of Mr. A. T. Snell, well known as the designer of much of the Immisch apparatus, on the output of dynamos (237), a paper which contains the results of a long and valuable experience in the practical field.

In connection with the various forms of dynamo the motor naturally takes its place as a proper subject for discussion. Of making motors there is no end, and several new forms have been brought to notice this year, the most interesting perhaps being the Duncan multipolar motor (335), notable as a very ingenious attempt to secure that desideratum of motor service, the combination of efficiency and low speed. Somewhat more theoretical, but still of great interest to practical electricans, is the report of the remarkable tests made abroad with alternating current motors of the Ganz type (223, 270). The machines have been known for some time, but the efficiency tests, only recently published, show such satisfactory progress in the development of the alternating motor as to inspire considerable hope for the future in that type of machine. Prof. F. B. Crocker has drawn on his wide practical experience for very many useful and suggestive hints (114) on the subject of motor testing, which in the growing importance of the commercial use of small motors is a subject of no little importance, although too generally neglected. In that department of motor service which belongs to the electric railway there has been continuous progress throughout the year. The growth in electric roads has been prodigious, and a number of important papers have added in the most material way to our knowledge of the theory and practice of electric railroad work. Specially among these are to be noted the brilliant paper of Mr. Sprague (147), read before the National Electric Light Convention; that of Mr. Irving Hale (330), and the discussion of the possibilities of the motor in general railway work, by Mr. O. T. Crosby (361). The first of these papers calls especial attention to the class of facts that bear on the extension of the sphere of the electric motor to railway service and is a theoretical discussion of the very interesting questions that would necessarily be raised in this connection. Mr. Crosby takes up the subject from a thoroughly practical standpoint and shows in a most complete and satisfactory manner the enormous possibilities of the electric locomotive applied to the work now done directly by steam. It is the most thorough and scholarly study of this particular problem that has yet appeared. Another branch of railway service, storage battery traction, has received careful discussion at the hands of Mr. Reckenzaun (388), who, although the results were first given to the public in England, obtained his data from experiments made in this country. In the growing importance of electricity as a factor in city life the storage battery car is deserving of more and more attention, and Mr. Reckenzaun, from his intimate acquaintance with facts, was enabled to make considerable additions to our previous knowledge of the subject. Also to be mentioned are the organization of the Westinghouse Electric Railway Company, and the active pushing forward of the Short Electric Railway Company.

Another field in which the electric motor is rapidly taking its place is that of mining. Both for traction in mines and for the operation of mining machines it has made remarkable progress during the past six months. Many inventors seem to have turned their energies toward devising practical electric drills and coal cutters (77, 225, 272, 349, 408), and the growing use of such apparatus is a sufficient evidence that its valuable qualities are appreciated. The mining locomotive, too, has taken its place in the equipments of more than one large establishment (12, 77), and it is interesting to note that in one large mine at Scrantor, Pa., such a locomotive is in daily use to draw loads of 100 tons and over, which it handles smoothly and easily at a rate as high as six miles per hour.

The electrical battery has not been neglected of late, and more especially the accumulator now bids fair to push its way into extended use. The important decision of Judge Coxe (230) seems to have given a considerable stimulus to at least one branch of the storage battery industry, and there is promise of immediate and rapid development in more than one direction.

Of electrical instruments, several brought into prominence during the last six months are worthy of special notice. The Fiske range finder (93,178) has been subjected to an number of exhaustive sea trials and has acquitted itself in a manner that speaks well for its probable usefulness in the dire exigencies that demand its use. The growth of electric lighting has demanded improved measuring instruments of every kind, and among many electric meters that have been the result of the ingenuity both of this country and elsewhere we may mention especially two—the Walker photographic meter (252), interesting theoretically as the embodiment of successful laboratory apparatus for commercial use, and the very beautiful meters that have resulted from Prof. Thomson's study of alternating currents.

Among other features in electrical industry we may mention the addition to our powers of insulation that seems to have come this year in the introduction of interior conduit tubing (401,423) in this country and the appearance of what seems to be a very extraordinary substitute for gutta percha in England (358).

Finally, we may pass from the more practical departments of electricity to some of the notable theoretical studies, and chief among them perhaps is the presidential address of Dr. John Hopkinson on magnetism before the Institution of Electrical Engineers. It is a brilliant résumé of the present state of our knowledge of magnetism and is full of intensely suggestive remarks on the theoretical side of that very interesting subject. Beside this we may mention the abstruse additions to the theory and the experiments of Hertz and the elaborate discussion of current distribution in networks by Herzog and Stark (300).

A particular branch of electrical study that has received more than usual attention very recently is the physiological effect of electrical current, and the English paper from the hands of Lawrence and Harries (287) is worthy of special mention. More important, perhaps, by reason of singularly careful scientific work, is the contribution of Dr. Tatum (314) to our knowledge of electro-physiology. His experiments are particularly important as showing something of the mechanism of the action of fatal electric currents and pointing out the probable marked differences in physiological action between the ordinary continuous and alternating currents, a subject which had heretofore been treated in a rather unscientific manner.

It may, perhaps, be thought that this record of six months' progress does not entirely bear out the remarks made in introducing the subject, but it should be remembered that, in this day of enormous electrical activity, something more than a brilliant research or a clever invention is necessary to claim recognition as a notable addition to the science of electricity.

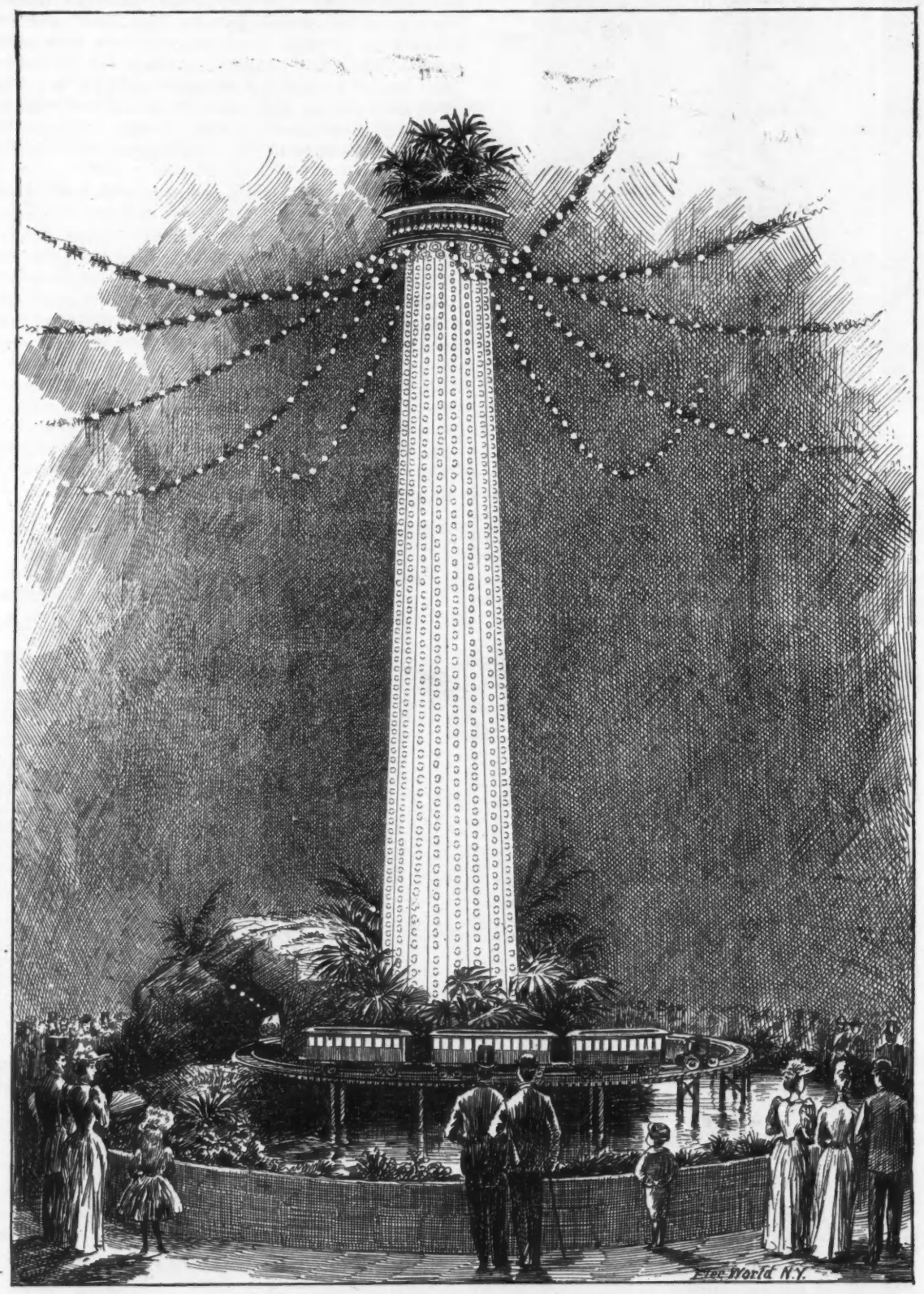
* References are to pages of The Electrical World. Vol. XV.

The Electrical Exhibit at Minneapolis.

The efforts that have been making to secure a complete exhibition of the electrical industries at the Minneapolis Industrial Exposition during the coming autumn have already been mentioned in our columns, and it gives us pleasure to be able now to announce that, through the energy of the general manager, Mr. William M. Regan, these efforts have been crowned with success. It is now settled beyond a doubt that the Northwest will this year enjoy an opportunity of examining and studying one of the most complete exhibitions of electrical devices that have as yet been gathered in any part of America.

The main feature of the fair will be, as has already been announced, the Edison exhibit from the Paris Exposition. This has recently been seen to great advantage in the Lenox Lyceum, in New York city; but at Minneapolis it will be arranged in sixteen corrugations. The lights will in the main be clear, but colors, red, green and blue, will be sparingly introduced to enhance the effect. They will be controlled from a switchboard in the basement of the building, and so arranged that the different rows can be operated separately or together. Thus one of the most beautiful effects produced at the Lenox Lyceum, that of lighting and extinguishing the tower slowly or rapidly, gradually or simultaneously, can be repeated at Minneapolis, but on a grander scale.

In the circular pool, already mentioned, will be placed on the surface, on the bottom, and at various intervening depths incandescent bulbs of all colors. It is intended also to place in the water a quantity of gold fish and other beauties, and it is to be hoped that a colony of that most valuable friend to electricians, the common frog, will be established on the banks of the pool to gaze sedately upon



PROPOSED EDISON LIGHT TOWER AT THE MINNEAPOLIS EXPOSITION.

very considerably enlarged and extended. In addition to the Edison, many of the other large companies will send exhibits, and it is reasonably certain that almost every branch of the trade will be amply represented.

The exhibition hall in Minneapolis is 366 feet square. The exact division of the 134,000 square feet of space thus available has not yet been definitely decided upon, but some of the plans are now practically settled, and the most striking of them we are already able to illustrate in the cut given on this page.

In the centre of the great hall of the exposition will be erected a huge electric light tower, 65 feet in height and of corresponding diameter. Surrounding this tower will be a pool of water, with all the usual effects of landscape—hills, marsh, lake, etc. A circular track constructed either on the inner or outer edge of the lake (this point is not yet decided) will give opportunity for running a train of cars by means of a Perret motor. The tracks will run through tunnels, over trestles, up and down grade and on the level. Current will be supplied through the rails, and automatic block signals will apparently control the movements of the train.

The tower itself will be a great mass of electric lights, the miraculous results of the twitching of their ancestors' legs.

The total circumference of the circle designed to include this exhibition of light and power, with its accessories of landscape and water, will be 300 feet. Grouped around it will be the remainder of the Edison exhibit, and in other parts of the great hall will be the exhibits of other electrical companies. As a whole, the Minneapolis Exposition of 1890 will certainly deserve to be a great and triumphant success.

In Actual Use.

We are glad to learn that the very ingenious arrangement of electric car tracks suggested in our columns by Professor Sweet is soon to be adopted in Rochester, N. Y., where the main features of the scheme are now in operation. A friend writes us this concerning the matter:

"The railway tracks upon one of the principal streets in that city are located upon each side, near the walk, and the space between curbing and walk—except between the rails—is nicely sodded. The road is at present operated by horse power, and the space between the rails is paved; but electric power is being put in, and when this change is completed, I was informed, the company intends taking up this pavement and sodding the space. It is operated as a double track road, the cars going up on one side and down on the other.

"All the advantages claimed by Professor Sweet are certainly realized. If any one doubts that this is the model method of locating street railway tracks upon residence streets, let him go and see and be convinced."

Fire in an Electric Light Station.

At 9:15 o'clock P. M., on Wednesday, the 11th inst., the central electric lighting station of the Manhattan Electric Light Company, located at the corner of Eightieth street and Avenue B, in this city, was struck by lightning and very heavily damaged by fire. The lightning did not strike one of the company's circuits and come into the building over the wires, for in that case the bolt would have gone to earth through the lightning arresters placed upon the lines, but it struck the roof of the building itself and originated the fire directly underneath the tower through which the wires enter and at the top of the incandescent light switchboard, and from this point the flames spread rapidly throughout the building wherever there was any combustible material to be consumed.

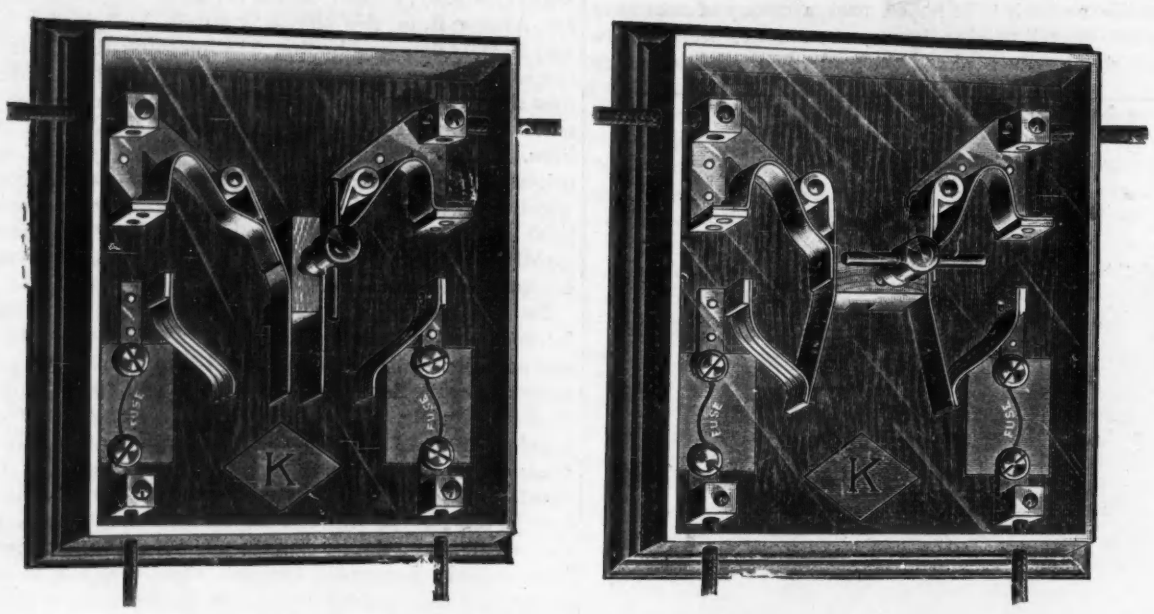
The equipment of this station was of an excellent quality, the building itself being of brick, with fire-proof floors and partition walls, although the tower furnished a passageway for the flames from the first to the second story. Customers using about 20,000 incandescent lights were supplied from 18 Slattery alternating current dynamos, while the arc lights were run from 11 machines of the Brush and Thomson-Houston types. The two switchboards, one for the arc lighting circuits and the other for the incandescent lighting, although near together, were kept entirely separate. Between them was a new and nicely furnished gallery, which had just been fitted up for the regulating devices of the incandescent circuits. The floor above the dynamo room was occupied by the offices and store rooms of the company, while upon the floor beneath was the engine room. This contained four 750 horse-power compound condensing engines and two 350 horse-power high-pressure condensing.

The damage done was confined to the dynamo room and the offices and store rooms, as the fire did not reach either the engine or boiler rooms. Out of about 30 machines only two or three of the arc dynamos, that were located furthest from the origin of the fire, escaped such serious injury as to make them unfit for use. The 18 Slattery dynamos sustained an average damage of perhaps $1,500 each; although it is difficult to tell just what the damage will be until the machines are put into the shop and overhauled. The arc light dynamos, being further from the burning switchboards, were not so seriously damaged, although they were considerably injured by water. The incandescent circuit switchboard, together with 280 switches, 64 ammeters and about 70 voltmeters, was entirely destroyed. Fifteen compensators, 18 rheostats and many other accessories were rendered worthless. The arc light switchboard, with its bank of switches, was partially consumed and will have to be rebuilt and refitted. Every belt in the station was so badly burned as to require an entirely new outfit. Of the four large 48-inch engine belts only one remained that could be repaired so as to be fit for use. Considerable damage was sustained upon the stock and upon the books, prints and drawings kept in the office of the engineering department.

The work of reconstruction and recuperation was begun at once after the fire, and the manner in which this has been done, and the rapidity with which the plant has been again put into running order, reflects great credit upon the management of the station, and is an illustration of the marvelous capabilities of a well-planned system of electric lighting. The night after the fire about one-half of the arc lights and 12,000 incandescents were supplied with current as usual, while on the second night 17,000 incandescents were connected, and on the third night not far from 20,000 lights. The company was able to make this fine showing through the kind assistance of its very obliging business rivals. Many of its lighting circuits, of which it has nineteen in all, were connected to other stations in the city, and have since been supplied by current from these stations. Meanwhile the company has been putting its own plant in running order. Five new Slattery dynamos were received soon after the fire from Ft. Wayne, Ind., by express, and other machines were sent for and received from the Thomson-Houston factory at Lynn, Mass., while the electric lighting companies in New York have very kindly loaned such machines as could be spared from their own equipment. By these various means the company has been enabled to replace in less than a week at least two-thirds of its entire plant, although, of course, this hasty installation has necessitated much work of a merely temporary character. When it is considered that the entire plant, with the exception of the engines, boilers and shafting, was rendered useless until replaced by new machinery, it must be admitted that the results obtained in so short a time reflect great credit upon Mr. E. A. Leslie, the general manager of the company, to whose energetic action much of the wonderful recuperation of the damaged plant is due.

The Knapp Combination Switch and Fuse Box.

After several months' testing on the alternating current circuits in the Union Stock Yards, Chicago, the Knapp Electrical Works has placed on the market the simple device known as the combination switch and fuse box, illustrated herewith. This double pole switch is designed to cut out a particular converter without affecting other parts of the circuit, and is intended to be placed on the primary wire at some point between the main wire and the converter. When service wires require repairing or testing the turning of the switch handle cuts off the current from the converter, to which the switch is attached, and



FIGS. 1 AND 2.—COMBINATION SWITCH AND FUSE-BOX.

the lines connected to it, and obviates all possibility of danger to the lineman. No other lights are affected by this action than those receiving current from this particular converter.

Beneath the lower contact points of the switch are placed fuse wire attachments that aid in preventing all danger from fusing by primary currents, an accident which might occur during wet weather or when the converter and switch are located on damp supports. The switch is made to break the circuit instantaneously, so that no sparking can occur between the contact points when cutting a converter in or out of circuit, while the sliding method of contact prevents the accumulation of dirt and keeps the contact points bright. The device is arranged to be used either right or left handed. Various sizes are made for different classes of work, and for exposed places the device is placed in a water-tight box.

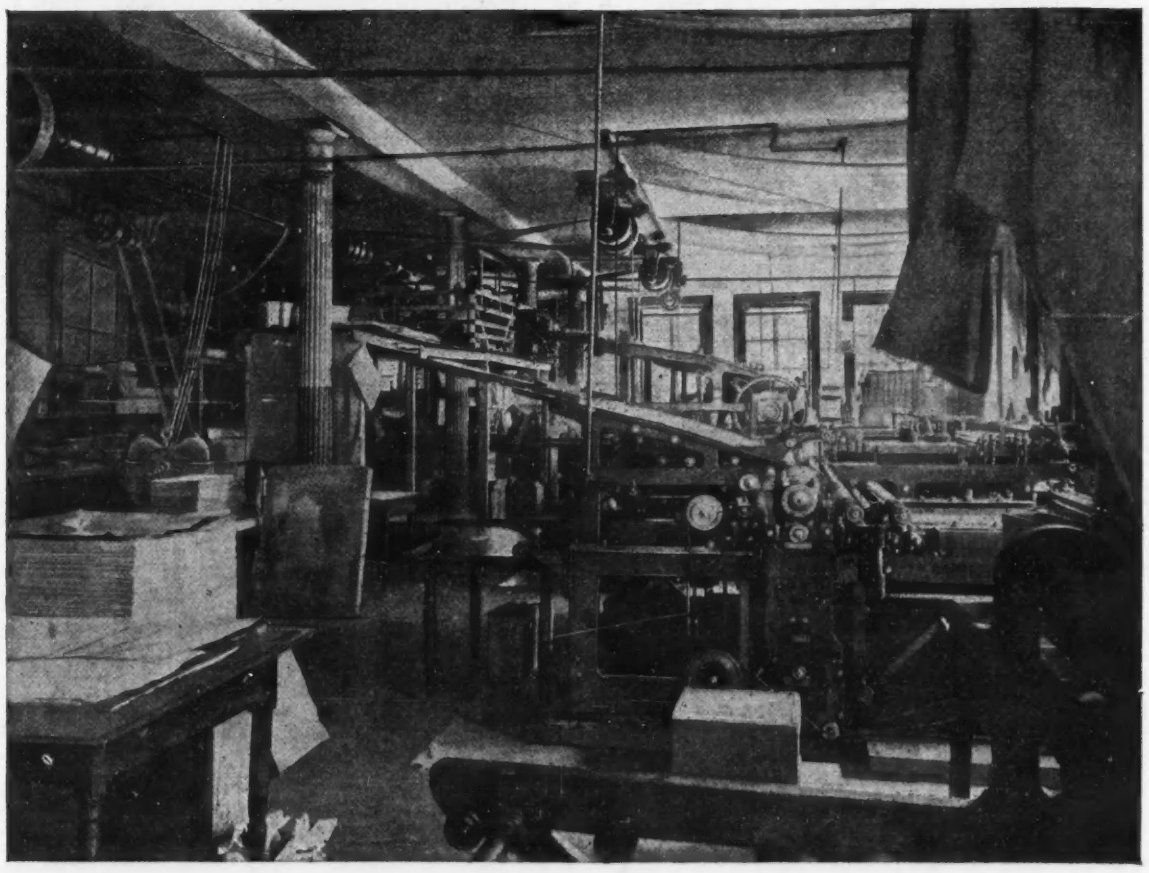
A New Type of Dynamo.

The Société des Telephones, of Zurich—a company formed for the various applications of electricity —recently sent to the London *Electrical Engineer* some particulars of a new type of dynamo, which for some little time the company has been constructing upon the designs of its engineer-in-chief, M. Mariotti. The particulars given will be of interest to American engineers. It is a multipolar machine, with ring armature, in which what is claimed as an entirely novel magnetic arrangement is adopted. While the dynamos constructed up to the present have had electro-magnets arranged either as exterior poles or as interior poles, in the new machine both exterior and interior poles are employed, which embrace the ring armature alternately. This arrangement is thought to possess special advantages. The lines of force must absolutely take the path of the iron in the armature, a direct path between the poles being impossible. The pole-pieces embrace the largest possible surface of the armature; and they come close to the neutral line, a thing which is not practical with any other type of dynamo without prejudice to its efficiency. It is to this point that is attributed the entire absence of sparking at the brushes, as well as the negligible displacement of the neutral line at variable load. The peculiar arrangement of the magnetic field is said to reduce the heating of the iron in the armature, produced by the action of hysteresis, to a minimum. Good ventilation is obtained, and, in general, the arrangement of the machines shows both solidity and simplicity of mechanical construction. The extent of the pole-pieces is not restricted by the dimensions of the armature ring, as is the case with dynamos with interior poles. The new arrangement, moreover, allows the employment of armatures of considerable diameter without the necessity of increasing the field-magnets disproportionately, as is necessarily the case in many systems of dynamos with exterior poles. The system is claimed to be advantageous for slow-speed dynamos, and especially for motors, and it is said that the tests made with a 20 h. p. dynamo have thoroughly proved the advantages theoretically to be expected by this novel disposition of the magnetic circuit, so much so that this innovation is regarded as one of real progress in the construction of dynamos.

Further Adoption of Electric Cars in Richmond, Va.

The history of commercially successful electric railways in this country began in Richmond, Va., and upon the road installed there in 1887. The superiority of electricity over horse power for propelling street cars here received its first experimental demonstration. Although the apparatus then installed was about the first that had been designed for the purpose, and has since been replaced by larger and better machines, the system was a marked success, and from it have been developed many of the improvements since applied in electric railway construction.

Besides the Richmond Passenger Railway, which was first equipped, there are two other important street railways in that city, and it is interesting to note that these (the Richmond City Railway and the Richmond and Manchester Railway) have decided to supplant the mule power, now considered antiquated, by the electric system of propulsion. The contracts for the equipment of these two roads, the one with the City Railway Company being for 10 cars and that with the Richmond and Manchester Railway Company for five cars, have been awarded this month to the Sprague Electric Railway and Motor Company.



PRINTING MACHINERY OPERATED BY SPRAGUE MOTOR.

A Prize for the Best Meter.

A competition will take place next autumn in Paris for a prize of 10,000 francs offered by the municipality for the best ampère meter or watt meter submitted. The meters submitted may be applicable to either continuous or alternating currents, or to both, but only in the latter case will the full prize be awarded. The judges, nine in number, will consider the following points:

(*a*) Exactness and accuracy throughout the entire scale, beginning in the one case at 2-10 ampère and in the other at 20 watts.

(*b*) Practical value; regularity, simplicity, cost, etc.

(*c*) Energy lost or consumed by the meter.

(*d*) Facility of employment in distribution of current.

The machines entered for competition must be deposited in Paris during the week ending Aug. 31. In addition to the capital prize, minor premiums of two and one thousand francs will be awarded.

Consolidation of Electrical Interests.

A circular was issued to the stockholders of the Oregon & Transcontinental Company, June 16, by Henry Villard, its president. announcing the fact that the company had been reorganized under the laws of New Jersey with a capital stock of $50,000,000, and that the name by which the new organization would be known was the North American Company. It is intended that the company will operate in another field in addition to that of railroad financiering. The circular says that "the other field will be the promotion of electric light and power enterprises. The substitution of the electric light for other illuminants, and of electric for steam power in manufacturing and transportation, that is now progressing all over the civilized world, and nowhere more rapidly than in this country, offers the greatest opportunities for the lucrative employment of large capital. It is expected that the company will have the closest affiliation, as a stockholder and otherwise, with the Edison General Electric Company and the Thomson-Houston Electric Company."

The scope of the new company may be seen from the articles of incorporation, which say that the company has been formed for the purpose of owning, leasing, managing and conducting railways, street railways, steamship corporations, telegraph and telephone lines, water works, gas works, oil works, mining, such as coal, iron, gold, silver, copper and other minerals, to transport freight and passengers by land and water, to manufacture electrical machinery, apparatus of all kinds, and to construct the same and acquire, hold, invest, etc., stocks, bonds, securities, and contracts and to borrow and raise money to any amount. Power is given to transact business in all the states and territories, Mexico, Central and South America, Canada, British North America and all countries of Europe. The principal offices are to be in Newark and New York.

Fine Printing Done by Electric Power.

The highest class of printing and engraving requires a steady and reliable power and one which is under the immediate and prompt control of the pressman. To secure perfect regularity and constant speed in addition to the above requirements many printers have adopted the electric motor in preference to other forms of power. The Sprague electric motors, because of their efficient regulation under varying loads, have met with great success in this class of work.

The accompanying illustration shows the press rooms of the Boston Bank Note and Lithograph Company, in which all the power used is supplied by a 10 h. p. electric motor. This is belted directly to the line of shafting running the length of the room, from which are run the presses, folders, cutters and other machinery used. Only a part of the presses are shown in the view, the shafting extending a considerable distance beyond the limits of the engraving. The motor occupies a space of less than 18 cubic feet, the engine for the same amount of work occupying from 10 to 15 times as much room. The Sprague Company has now about 20 motors in use in Boston for operating presses alone, while the total number in use in that city is not far from 200.

Heisler Electric Light Station at Union Hill, N. J.

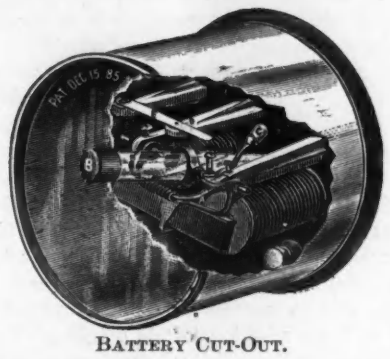
One of the most recently constructed electric lighting stations in the East is that at Union Hill, N. J. The plant has been completed and in running order for only a very short time, having been put in operation about one month ago, and is a model one in all respects, is well arranged for economy and convenience, admirably planned, and in its construction are embodied the latest and most advanced ideas upon central station design.

The main building of the station is of brick, one story in height, with a frontage of 60 feet and a depth of 45 feet. The entire floor of this building is occupied by the engine and dynamo rooms, the boiler room being in an addition at the rear of the main building. The equipment at present consists of a 125 h. p. Buckeye engine, belted to one 250-light and one 400-light Heisler dynamo, with switches, regulators and other accessory station apparatus of the latest type. Steam is furnished by Henry Warden boilers. The number of lights connected with the circuits is about 500, all of 32 c. p., used both for street and private lighting. The customers are all highly satisfied, and are paying less for their present light than was formerly paid for gas. Another engine and a duplicate pair of dynamos will be added to the equipment as soon as they are needed, the building being large enough to allow the present capacity of the plant to be doubled.

Our illustration shows an interior view of the engine and dynamo room and gives a good idea of the arrangement of the plant. The switchboard is shown upon the rear wall of the room. The door which leads into the boiler room is also shown. The plant was constructed by the Complete Electric Construction Company, of New York City, under the supervision of Mr. John A. Seely.

A Primary Battery Cut-Out.

The accidental short circuiting of primary batteries intended for open circuit work always results in more or less injury to the cells. Owners of small battery plants have often realized that there was a need of a simple device by means of which, when such an accident occurred, the battery would be automatically cut out of circuit. The accompanying cut represents a device intended for this purpose recently put upon the market by the Electric Supply Company, of Syracuse, N. Y. On the axles shown in the cut swing three independent parts, viz.: an armature, a yoke, *A*, bearing a counterweight, *C*, and a tube which is heavier at the end *B* and is half full of sluggish fluid. The tube may be of metal or glass, as desired. When attracted the armature pushes down the yoke *A*, letting the tube tilt slightly, and the fluid begins to flow slowly toward *B*. After a while the shifted weight of the flowing liquid tilts the tube and yoke still more, until the tube rests against the stiff contact spring *E*. The fluid then flows much faster, and soon its weight forces the spring away from the insulated contact screw *D*, cutting out the battery. To complete this operation the circuit must be closed for about 30 seconds. If the circuit is cleared before that period the counter-weighted yoke will restore the tube and the fluid will flow back to its normal position. No effect is produced in the instrument by lighting the gas if the batteries are used for electric gas lighting circuits. The cover to the instrument, which is shown partly broken away in the cut, has a glass front, and can very easily be removed whenever necessary.



BATTERY CUT-OUT.

The Second Electrical Exhibition at St. Louis.

The great success of the first annual electrical exhibition, which was held in St. Louis, Mo., in 1889, has led to the announcement that the second exposition of a similar nature will be opened in St. Louis, Wednesday evening, Sept. 3, of this year. The success of the exhibition of last year is well remembered by both exhibitors and visitors, and both of these classes of people will be pleased to know of the announcement referred to above, exhibitors because of the excellent opportunity thus afforded them of displaying to thousands of interested people any electrical apparatus which they may wish to bring prominently before the trade in the southern, western and southwestern sections of the country, and visitors because of the facilities they will enjoy for the study of the latest and best types of electrical apparatus and machinery of every description, and of the electrical progress in the last year.

A prominent feature of the exhibition is the awarding of medals for the best exhibits. Gold, silver and bronze medals and diplomas will be awarded upon the following articles at the coming exhibition:

Light.—For the best arc system; for the best direct current incandescent system; for the best alternating current system; for the best arc dynamo; for the best arc lamp; for the best direct current incandescent dynamo; for the best alternating current dynamo; for the best incandescent lamp; for the best electric light system for naval use; for the most complete incandescent lamp socket.

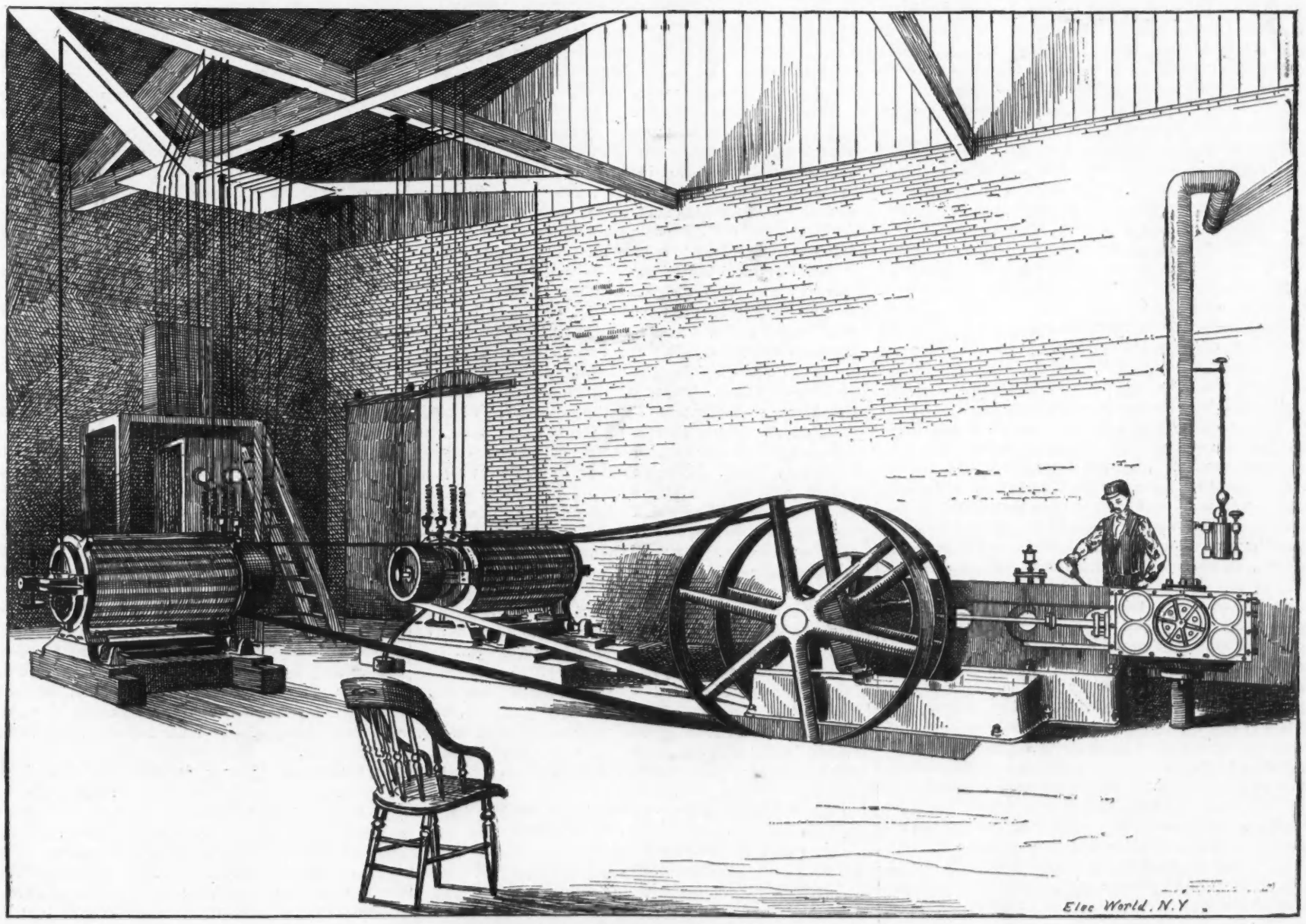
Power.—For the best constant potential motor for domestic use; for the best constant current motor for domestic use; for the most practical alternating current motor for domestic use; for the best electric power apparatus for naval use; for the best electric railway system; for the best mining motor; for the largest (h. p.) electric motor of any kind.

Storage Batteries.—For the most serviceable storage battery for light or power purposes.

Electrical Instruments.—For the best standard resistance box; for the best ammeter; for the best voltmeter; for the best portable ammeter and voltmeter for measuring direct and alternating currents; for the best standard galvanometer.

Wires and Cables.—For the best insulated wire for aerial lines, ability to resist abrasion and ability to resist deteriorating influences of the atmosphere to be considered; for the best waterproof insulated wire for inside use, insulation resistance, ability to resist abrasion, and ability to resist deteriorating influences of the atmosphere, ammoniac and sewer gases to be considered; for the best cable for subterranean work for telephone, telegraph and light and power purposes; for best cheap insulated wire.

General.—For best automatic safety shunt for protecting buildings connected with aerial circuits from overcharges of atmospheric electricity; for best public automatic danger signal for underground circuits; for best automatic electric valve and water operating device as applied to heat regulation and similar purposes; for best thermostat or automatic temperature regulators and controllers; for best electric heater for cooking purposes, also for domestic heating; for best electrical condensers; for best watchman's clock and fire and police alarm; best self-setting annunciator; best cash register; best dry or liquid battery that will work the longest without attention on open circuit work; best automatic, least liable to derangement, pendant gas lighting burners; best battery cut-out, etc.



THE HEISLER CENTRAL STATION, UNION HILL, N. J.

Power transmission: Most economical high and low speed steam engines and water wheels; best friction clutch pulley and coupling; best belt for dynamo purposes; best complete system of power transmission of any kind.

A special award will be made for the best electrical display, also for the most meritorious electrical invention patented since Oct. 19, 1889.

The above awards will be made by a committee composed of the following gentlemen: Mr. Carl Hering, of Philadelphia, appointed by the American Institute of Electrical Engineers; Mr. E. R. Weeks, of Kansas City, appointed by the National Electric Light Association, and one member chosen by the electrical fraternity at large.

On the Electro-Deposition of Platinum.*

BY WM. H. WAHL.

The permanence and unalterability of the metal platinum—properties which make it of such inestimable value to the chemist—have likewise suggested its application as a protective covering upon the surfaces of other metals; and even in the early days of the art of electro-deposition efforts to obtain a satisfactory coating of this metal were made. The failure with which these early experiments were attended served rather to stimulate than to deter subsequent investigators, and the problem has received the attention of a number of the most noted experts in the art. The results that have been accomplished cannot be said to have been entirely satisfactory—a statement which, I believe, will be fully sustained by the fact that electro-plating with platinum, on the commercial scale, is practised only to a very limited extent. When the wide field of application for platinum plating is considered—and I need only name philosophical, engineering, surgical, dental and electrical apparatus and instruments, fire-arms, watch-cases, and jewelry, to say nothing of the host of miscellaneous articles of utility and ornament to which the metal could be advantageously applied—the conclusion is irresistible that the processes thus far proposed for the purpose do not fully meet the requirements of practical service.

Thus far, of all the methods that have been proposed for electro-plating with platinum, three only appear to have sufficient merit to deserve special notice; these are:

1. Roseleur-Lanaux method, based on the electrolysis of a solution of the double phosphate of sodium and platinum.

2. The process of the Bright Platinum Plating Company (of London), a modification of that of Roseleur, involving the introduction into the bath of certain substances, such as sodium chloride and borax, to insure a bright deposit of the metal; and

(3) Boettger's method, founded on the electrolysis of a solution of the double chloride of ammonium and platinum in sodium citrate.

Each of these baths will yield satisfactory results for a time; but, as I shall endeavor to show, the peculiar difficulties met with in the practice of platinum-plating render it impossible to maintain the chemical integrity of these electrolytes, and, in consequence thereof, they soon become inefficient or inoperative by reason of contamination with the secondary products formed therein.

I will endeavor in what follows to give the true explanation of the difficulties above referred to, and to indicate what, from a careful study of the subject, fortified by the results of numerous experiments, I conceive to be the only feasible method of overcoming them.

The first difficulty encountered is that of obtaining a bright, reguline and adherent deposit of the metal, in which form only it will answer the demands of practice. There is no difficulty in effecting the separation of the metal from solutions of almost any of its compounds. Zinc, iron and tin reduce it promptly by simple immersion, and this very facility of reduction is one of the reasons why, even by the method of electrolysis, the desired object is frequently accomplished only in an imperfect manner; for the electroplater is obliged to meet and overcome its obstinate disposition to separate from many of its compounds in the condition of platinum black, lacking coherence and adherence, and therefore entirely unsuited for his purpose.

Another and no less serious difficulty arises from the insolubility of plates or sheets of this metal as anodes, when solutions containing platinum salts are submitted to electrolysis. In electro-plating with copper, silver, gold and nickel but little difficulty is encountered in practice on this account, since anodes of these metals are freely soluble in many solutions capable of depositing them when they are submitted to electrolysis, and the rate at which these anodes are respectively dissolved approximates so nearly to that at which the metals are deposited upon the objects at the cathode, that the metallic strength of the electrolyte is maintained substantially uniform, and electro-plating solutions of these metals may be operated for a long time without requiring additions of metallic salts. The electro-deposition of the metals whose anodes are thus tractable is carried on industrially with success.

It results from this want of solubility of the anode that the metallic strength of the electrolyte employed is continuously being weakened, while the deposition of the metal is going on and the conductivity of the bath is being continually modified thereby. The character of the deposited metal also is injuriously influenced by these constant alterations of condition in the bath; and, as the rate of deposition becomes slower and slower by reason of the gradual impoverishment of the metallic strength of the solution, it will be necessary to restore it by fresh additions of metallic salt. The practice in all the processes of electro-plating with platinum employed up to the present time, save that of Boettger, is to use for this purpose the tetra-chloride of platinum. With this single exception, all the solutions for the electro-deposition of platinum thus far made known, so far as I am aware, are made by treating the chloride with compounds of the alkalies, soda, potassa, or ammonia. Of these, the phosphates and oxalates of soda or potassa are in greatest favor, and a number of formulæ for preparing platinum-plating baths with their aid have been described. The resulting substance is commonly a double salt, such, for example, as the double phosphate of sodium and platinum; the double oxalate of potassium and platinum, etc., contaminated, however, in each case by the chloride of the alkali employed, which is formed from the decomposition of the platinic chloride. As often as it is found necessary to strengthen the bath, fresh additions are made of platinic chloride, which by chemical interaction with the constituents of the bath, aided by the process of electrolysis, yields more alkaline chloride; and it follows that the bath, by reason of becoming surcharged with this foreign substance, and with other secondary products of electrolytic decomposition, ceases to yield bright, reguline platinum upon the articles to be plated therewith and must be discarded. It then becomes necessary to regain the platinum contained in the discarded bath, by one or another of several processes of reduction known to chemists. The platinum thus regained may be converted into chloride and utilized in the preparation of a fresh bath, with which the same series of operations will be repeated. Boettger purposes to maintain his bath by fresh additions of his original solutions, but it must be apparent that the continued electrolysis of such a solution as he employs must be attended with the constant accumulation therein of alkaline chlorides from the same causes as those specified above. This rapid deterioration of the baths, therefore, involves their frequent renewal at the expense of time and labor, so that, in spite of the fact that there is a wide field for its application, it is principally for this reason that the art of electro-plating with platinum on the commercial scale has thus far been practised only to a very limited extent.

It occurred to me that it might be practicable to overcome the principal difficulty here set forth. Knowing the influence of extent of surface in promoting the solubility of substances, it appeared to me at least probable that if the platinum were exhibited at the anode in the form of platinum black, or sponge, exposing thus an enormously greater number of points of attack to the electro-negative element or acid radical there set free, the result might be the solution of the platinum, and the problem of maintaining the metallic strength of the electrolyte would thus be solved. The correctness of this conjecture was verified by experiment. For this purpose a plate of porous battery carbon previously treated with boiling hydrochloric and nitric acids was saturated repeatedly with a solution of platinic chloride and dried. It was then introduced into a graphite crucible, finely divided carbon was packed about it, and the crucible and contents heated for about half an hour to bright redness. The carbon plate then contained within its pores platinum in a state of eminently fine division. Treatment with water and with hydrochloric acid at boiling temperature failed to leach out any platinum salt, showing that the previous treatment had sufficed to reduce all the platinum salt to the metallic state. The carbon plate was then suspended as the anode in moderately diluted hydrochloric acid, a platinum plate serving as the cathode. The acid bath was gently heated and a current of moderate strength was allowed to flow through it. There was a liberal evolution of hydrogen from the cathode, but little perceptible evolution from the anode. The acid solution gradually became colored from the formation of platinic chloride, and after some time the bright surface of the cathode began to blacken and ultimately became covered with a thick coating of platinum black. It was thus demonstrated that an anode of platinum in a fine state of division is readily soluble in an electrolyte which yields chlorine at the anode when the same is electrolyzed. This observation, so far as I am aware, is new. It proved, however, to have no practical value, since the solution of the anode demanded the presence of a large proportion of free acid in the plating bath and the use of currents of such strength as to produce invariably the deposition, on the surfaces to be plated, of black and non-adherent metal. Furthermore, it was found, as was to have been anticipated, that the physical condition of the anode exerted no influence whatever in the electrolysis of baths formed of the oxy-salts of platinum, from which the best results in electro-plating are obtained—since, in electrolyzing such compounds, the acid radical separated upon the surface of the platinum black failed to exert any perceptible solvent action.

It was therefore necessary to devise some other plan for overcoming the difficulties herein described, and, after making a number of fruitless experiments, I was so fortunate as to find a plan which appears to offer a solution of the troublesome problem of electro-plating with the group of metals whose anodes are insoluble, in a more satisfactory manner than any other that has hitherto been suggested.

The plan here referred to consists in employing platinum hydroxide for the purpose of maintaining the metallic strength of the plating bath. For this purpose, the hydroxide, which is readily soluble in alkalies and in many of the acids, may be introduced into the plating bath from time to time and dissolved therein by stirring, or it may be permitted to remain in the bath in excess, the undissolved portion remaining at the bottom of the containing vessel, or it may be suspended in a canvas bag adjacent to or surrounding the anode of carbon, according as the nature of the electrolyte may indicate one or the other method to be the preferable one. As the solutions which yield the best results in plating are those of the oxygen salts, I have found it advantageous also to prepare these directly from the hydroxide. This method, I have found, is capable of yielding a number of electrolytic baths of platinum that will maintain their metallic strength approximately unimpaired during electrolysis, and without the objectionable features of introducing into them substances that will cause them to deteriorate by the accumulation therein of injurious secondary products of decomposition, as is the case where such baths are maintained by additions of platinic chloride or alkaline chloroplatinates, as has hitherto been the invariable practice. Refering now specifically to the properties that render the platinic hydrate useful for the purposes above indicated, the following points appear to be deserving of mention.

It is readily soluble in aqueous solutions of the alkaline hydrates, and in a number of acids, mineral and vegetable. In the treatment of the platinic hydrate with aqueous solutions of the alkaline hydrates, the former plays the part of a weak acid forming compounds known as platinates, which are very soluble, and from which the platinum is not precipitated on the addition of an excess of alkali. A weak aqueous solution of sodic or potassic hydrate (but especially the last named) will dissolve a large quantity of platinic hydrate, at the ordinary temperature, though solution takes place more freely when heat is applied. These solutions have the advantageous features of being freely conductive of electricity, and of yielding bright, reguline, and adherent electro-deposits of platinum on metallic surfaces previously prepared to accept the same. Furthermore, with a current of moderate strength, the platinic hydrate only is affected, as is shown by the pronounced evolution of oxygen at the anode and by the total absence of gas at the cathode. Also, it is manifest from the free solubility of platinic hydrate in alkaline hydrate, even in the cold, that if free platinic hydrate be present in a bath of alkaline platinate, the alkali set free in the process of electrolysis will combine with this platinic hydrate to form fresh platnate. For this purpose, it will be necessary either to have present in the bath at all times a small excess of platinic hydrate which may remain upon the bottom of the containing vessel, without interference with the plating, and which may be replenished from time to time; or, to introduce at the end of the day's work a quantity of the platinic hydrate sufficient to restore the metallic strength of the bath to normal, assisting the solution of the metallic hydrate by stirring, and, if necessary, by the application of gentle heat. As I have found that the platinate solutions act best when they contain a considerable excess of free alkaline hydrate, being more conductive of the current and yielding the platinum more freely and in the best condition, the addition of the proper quantity of platinic hydrate at the close of the day's work in the case of a bath of considerable volume, or the addition of small quantities at intervals, in the case of a small bath, will be found to answer the desired purpose of maintaining the metallic strength of the bath approximately normal for an indefinite period. In a bath where considerable free alkali is present, the platinic hydrate added as just indicated dissolves very freely, even in the cold. The important fact is to be noticed, that the alkaline platinate solutions may be maintained and operated for a long time in the manner described, since no deleterious secondary products are formed by electrolysis to vitiate and render them inoperative, as will speedily be the case where the platinic chloride is used for this purpose. The mineral acids (hydrochloric, nitric, sulpuric and phosphoric acids) dissolve the hydroxide freely, as likewise do certain of the vegetable acids, notably oxalic acid, and form with corresponding salts of the alkalies, double salts, many of which are soluble in water. Of the salts thus capable of being formed, however, so far as I have been able to determine by experiments, only a limited number appear to be adapted to yield a deposit of bright, reguline and adherent platinum. The halogen compounds may obviously be prepared more conveniently by the direct solution of the metal in *aqua-regia* than by the method I have described, but as I have found the oxygen compounds of platinum to yield much more satisfactory results, I therefore exclude them from consideration.

Of the salts that may be formed from platinic hydrate by solution in acids (and in part by suitable combination with the corresponding alkaline compounds to form double salts), three only may be named as sufficiently useful to yield practically valuable results in plating. These are the phosphates, oxalates and acaetes, of which also it is practicable to form double salts with the alkalies, soda, potassa and ammonia, which yield bright, reguline and adherent plating.

Oxalic acid, so far as I have been able to determine, of all the oxygen acids, is the best solvent of platinic hydrate, dissolving it even in the cold, but with great energy when aided by heat, and forming platinous oxalate, with evolution of carbonic anhydride. From this brownish-black or deep blue solution (according to concentration) brilliant reddish-brown scales of the salt separate abundantly and readily from the hot saturated solution. A saturated aqueous solution of the simple oxalate prepared from the hydrate as above described will yield bright, reguline, adherent platinum when electrolyzed with a comparatively weak current, with evolution of carbonic anhydride at the anode. With a stronger current hydrogen also appears at the cathode. This bath may be maintained indefinitely at normal metallic strength by observing the precaution to

* Read at the stated meeting of the Chemical Section of the Franklin Institute, May 20, 1890.

add oxalic acid and platinic hydrate in small quantities from time to time; or by keeping constantly at the bottom of the bath some platinic hydrate, and adding oxalic acid in crystals or powder from time to time as may be required to keep the bath saturated; or, what is much to be preferred, making a supply of platinous oxalate from platinic hydrate in the manner previously described and keeping an excess of this present in the bath at all times. This bath has the same advantages that are possessed by the above-described alkaline platinate baths, of being capable of indefinite maintenance at normal metallic strength and of ntroducing no substances that will cause its deterioration by the formation of secondary decomposition products.

Phosphoric acid also is a solvent of platinic hydrate. A dilute aqueous solution of this acid will dissolve a small quantity of the metallic hydrate in the cold, and a much larger quantity when aided by heat. With increasing concentration, the solvent power of this acid for platinic hydrate is correspondingly increased. The resulting solution of phosphate of platinum according to the degree of concentration, will be wine-yellow to cherry-red in color, and with a comparatively weak current will yield bright, reguline and adherent platinum on metallic surfaces properly prepared to accept the same. The electrolysis of this compound, also, does not involve the formation of deleterious secondary products, the result of the operation being the separation of the metal at the cathode and of the acid radical at the anode—and of the elements of water which are evolved as gases respectively from anode and cathode. In the operation of the bath, therefore, it will become more and more acid as the metal is withdrawn by the accumulation therein of the phosphoric acid set free at the anode. The maintenance of the metallic strength of the bath, therefore, may be effected as in the foregoing cases by having present therein at all times a small quantity of platinic hydrate or by the addition at the end of each day's work of the quantity of the metallic hydrate which will be required to restore the amount of metal withdrawn. This bath must be worked very acid, and the solution of the platinic hydrate to maintain the strength of the bath must be facilitated by heating, as the solvent power of phosphoric acid for platinic hydrate is much inferior to that of oxalic acid. The double phosphates of platinum with certain of the alkalies may be formed, which will be capable of yielding a deposite of bright, reguline and adherent metal, and of being maintained approximately at normal metallic strength in the same manner as I have set forth above. The best results I have obtained with the ammonio-platinic phosphate, prepared by adding to the solution of platinic hydrate in phosphoric acid sufficient aqua ammoniæ to cause the same to give an alkaline reaction, which point will be indicated by the formation of a grayish precipitate that will not disappear on stirring; then restoring the acidity of the solution by adding free phosphoric acid in excess, upon which the precipitate readily dissolves. The resulting solution is yellowish or brownish, and yields superb plating; though, on account of the greater difficulty of maintaining its metallic strength by the solution of the hydroxide, it is not so well adapted as the oxalate for the work of electro-deposition on the large scale. The sodio-platinic phosphate, formed in a manner precisely analogous to the ammonia compound just described, will also yield bright, reguline and adherent plating; but I have observed that the soda salt is less freely soluble than the corresponding ammonia compound, and consequently more difficult than the latter to maintain of normal metallic strength.

Platinic hydrate is only very sparingly soluble in strong acetic acid, and it is impracticable to facilitate the solution by boiling, since by persisting in this for a very short time, the hydrate is decomposed and black platinic oxide is formed, which is quite insoluble in this menstruum. I have found, however, that an alkaline acetate bath may be prepared by the addition to the alkaline platinates above described, of as much acetic acid as may be introduced without causing the formation of a permanent precipitate. But although the appearance and quality of the plating obtained with this bath leave nothing to be desired, the bath does not meet the requirements in respect of indefinite maintenance in normal metallic strength and uniform composition. This difficulty, however, as I have observed, becomes less and less pronounced as the bath is made more strongly alkaline, when it approximates more and more closely to the alkaline platinates; for it is obvious that in the presence of a large amount of free alkali, this would unite with the acetic acid to form a simple acetate. The resulting solution would no longer contain sodio-(potassio-)platinic acetate, but sodic (potassic) acetate, sodic (potassic) platinate, and free alkali. Nevertheless, the presence of acetic acid in such alkaline bath appears favorably to influence the quality of the plating yielded, giving the deposited metal a whiteness approaching that of silver; and since furthermore, acetic acid yields only the elements of water and volatile compounds when electrolyzed, and therefore does not contaminate the electrolytic bath by forming deleterious secondary products, I find its judicious addition to the above-described alkaline platinate baths to present some advantages.

The foregoing comprise the compounds that I have found to yield the most satisfactory results in platinum plating, and I will not tax your patience at this time by an enumeration of the results, either partially successful, or wholly unsuccessful, that I have obtained with a number of differently constituted compounds of this metal.

I append directions for the preparation of the several electrolytic baths above described, and indicate what I have found to be the most favorable conditions for working them.

In conclusion, I desire to make known the fact, which was brought to my knowledge only within the past week, that my friend, Prof. Wm. L. Dudley, of Vanderbilt University, Nashville, Tenn., has independently worked out the problem of electro-plating with iridium in a manner precisely analogous to that which I have herein described with platinum. Professor Dudley has made no publication of his research, but in a letter, informs me that he employed, as long ago as 1886, the following procedure, which I quote, "a bath of the metal may be composed of either the chloride ($IrCl_4$), the double chloride of iridium and sodium, a double sulphate of iridium-ammonium. The latter was preferred. The bath was kept saturated with metal by suspending canvas bags in the solution (either near to or around the anodes) containing the hydroxide of iridium."

DIRECTIONS FOR PREPARING THE ELECTRO-PLATING BATHS.—For the alkaline platinate bath, the following directions may suffice:

Platinic hydrate	2 ounces.
Caustic potassa (or soda)	8 ounces.
Distilled water	1 gallon.

Dissolve one-half of the caustic potassa in a quart of distilled water; add to this the platinic hydrate in small quantity at a time, facilitating solution by stirring with a glass rod. When solution is effected, stir in the other half of alkali dissolved in a quart of water; then dilute with enough distilled water to form one gallon of solution. To hasten solution, the caustic alkali may be gently heated, but this is not necessary, as the platinic hydrate dissolves very freely. This solution should be worked with a current of about two volts and will yield metal of an almost silvery whiteness upon polished surfaces of copper and brass, and quite freely. There should be slight, if any, perceptible evolution of hydrogen at the cathode, but a liberal evolution of oxygen at the anode. I have observed that the addition of a small portion of acetic acid to this bath improves its operation where a heavy deposit is desired. The anode may be of platinum or carbon, and owing to the readiness with which the metal is deposited an excess of anode surface is to be avoided. Articles of steel, nickel, tin, zinc, or German silver, will be coated with black and more or less non-adherent platinum; but by giving objects of these metals a preliminary thin electro-deposit of copper in the hot cyanide bath, they may be electro-platinized in the alkaline platinate bath equally as well as copper. The bath may be worked hot or cold, but it is recommended to work it at a temperature not exceeding 100° F. It may be diluted to one-half the strength indicated in the formula and still yield excellent results. The surface of the objects should be highly polished by buffing or otherwise, prior to their introduction in the bath, if the resulting deposit is designed to be brilliant.

The deposition of platinum takes place promptly. In five minutes, a sufficiently heavy coating will be obtained for most purposes. The deposited metal is so soft, however, that it requires to be buffed very lightly. A heavier deposit will appear gray in color, but will accept the characteristic lustre of platinum beneath the burnisher.

The oxalate solution is prepared by dissolving one ounce of platinic hydrate in four ounces of oxalic acid and diluting the solution to the volume of one gallon with distilled water. The solution should be kept acidified by the occasional addition of some oxalic acid. The simplest plan of using this bath, and which requires no attention to proportions, is simply to work with a saturated solution of the oxalate, keeping an undissolved excess always present at the bottom of the vessel. An addition of a small quantity of oxalic acid now and again will be found advantageous. The double salts of oxalic acid with platinum and the alkalies may be formed by saturating the oxalate of the desired alkali with platinic hydrate, and maintaining the bath in normal metallic strength by the presence of an undissolved residuum of platinous oxalate.

The double oxalates are not so soluble in water as the simple salt. The oxalate baths, both of single and double salts, may be worked cold or hot (though not to exceed 150 degrees F.), with a current of comparatively low pressure. The metal will deposit bright, reguline and adherent on copper and brass. Other metallic objects must receive a preliminary coppering as above. The deposited metal is dense, with a steely appearance, and can be obtained of any desired thickness.

The deposit obtained in the oxalate baths is sensibly harder than that from the alkaline platinate bath, and will bear buffing tolerably well.

The phosphate bath may be prepared by the following formula:

Phosphoric acid, syrupy (sp. gr. 1.7)	8 ounces.
Platinic hydrate	1-1½ ounces.
Distilled water	1 gallon.

The acid should be moderately diluted with distilled water, and the solution of the hydrate effected at the boiling temperature. Water should be added cautiously from time to time to supply that lost by evaporation. When solution has taken place, the same should be diluted with sufficient water to make the volume one gallon. The solution may be worked cold or warm to 100 degrees Fahr., and with a current much stronger than that required for the platinates and oxalates. The ammonio-(and sodio-) platinic phosphates may be formed from the simple phosphate by carefully neutralizing the solution of the phosphate with ammonia (or soda); then adding an excess of phosphoric acid, or enough to dissolve the precipitate formed and an additional quantity to ensure a moderate amount of free phosphoric acid in the bath. The phosphate baths will be maintained of normal strength by additions of platinic hydrate, the solutions of which will have to be assisted by heating the bath, preferably at the close of each day's work. The metal yielded by the electrolysis of these phosphate solutions is brilliant and adherent. It has the same steely appearance as that exhibited by the oxalate solutions, but to a less pronounced degree. The physical properties of the deposited metal are in other respects like those described in connection with that obtained from the oxalate baths.

The Progress of Electrical Traction.*

BY DR. LOUIS BELL.

It is not at all my purpose this evening to inflict upon you a scientific lecture on the theory of the electric motor and the ways in which it is modified to suit the exigencies of electrical traction. I merely wish to call attention to what has been done toward replacing the motive powers which we, our fathers and grandfathers were wont to use by the much more powerful and convenient method which you see on your streets to-day. In addition, it may be worth while to look ahead a little, and, after seeing what difficulties were met and have been overcome, to look at what now remains to be done and fix in our mind's eye the magnificent possibilities of future development.

The history of electrical traction is fortunately brief, for the most of it has been growing under our very eyes within the latter half of the last decade. Were I possessed of an archæological devil, like certain imaginative fellow-beings of ours, I might go back into the mythical history of the early Egyptians and try to find indications of electrical development among the inscriptions of the Ptolemies, or search for a possible nigger on the core among the Ethiopian figures on the obelisks. As it is, however, I shall simply ask you to turn back your minds a mere half century to that decade which saw the introduction of a railroad and a telegraph, and was crowded with all the early developments of electro-magnetism. Less than a dozen years after the discovery that an electric current possessed magnetizing powers, the acute early investigators began to look toward the possibility of its use as a motive power, and the earliest and most important investigator was Jacobi, who, during the years from 1834 to 1839, evolved many rudimentary forms of motor. But we may take pride in the fact that the first man to build an experimental electric railroad was one of our own countrymen, a Yankee from the Green Mountain State, Thomas Davenport by name. In the autumn of 1835 Davenport set up a little circular railway at Springfield, Mass., and afterward exhibited it for a fortnight in Boston. Nothing, however, came from his experiments except the interesting scrap of history that keeps his name alive.

Three years later Jacobi opened up another branch of possible electric traction in an electric boat at St. Petersburg. His motor was a most rudimentary affair, and the best it could do was to cause a 28-foot launch to crawl up and down the Neva at the rate of three miles an hour. Meanwhile the countrymen of Davy and Faraday had not been idle. About 1839, Robert Davidson of Scotland, now living at an advanced age in British Columbia, built an electric locomotive, operated, of course, by batteries, with which he reached a speed of four miles per hour. He has lived to see the invention of his youth a powerful factor in the civilization of his old age.

But it is again to a countryman of ours that we must turn for the first practical effort. Prof. C. G. Page, well-known to electrical students as the inventor of divers ingenious electrical whirligigs which are of no practical use, but illustrate the principles of electro-dynamic action in the most beautiful manner, had high hopes of electric traction, and in the spring of 1851 his electric locomotive started out from Washington along the railroad track toward Baltimore. It was a crude affair, in which the reciprocating pull of a pair of U-shaped electro-magnets was transformed into rotary motion by a crank; but it was of 16-h. p., and in that first run, in spite of accidents, it reached a speed of 19 miles per hour. But Page and all those who succeeded him were severely handicapped by the absence of anything like a rotary electric motor. So long as it was necessary to transform reciprocating into rotary motion, as is done in a steam locomotive to-day, the electric motor was at an enormous disadvantage; nor was there then any convenient source of electricity. The dynamo, it must be remembered, is less than a quarter of a century old, and the primary battery then, as now, was insufficient for any important development of power. The beginning of electrical traction, or rather of its possibility, dates from that magnificent discovery of the reversibility of the dynamo, a discovery that, perhaps, cannot be ascribed to any one person or to any definite year, but was

* A Paper read before the Scranton Science Club, June 19, 1890.

in the air during the sixties, as the telephone was in the succeeding decade.

Perhaps the keen mind of Pacinnoti, who may be fairly called the inventor of the modern dynamo, was one of the first to perceive the principle. It is really a very simple one. Just as a loop of wire revolved between the poles of an electro-magnet has a current generated in it, so, if the current be supplied from an external source, the loop will tend to rotate. It is this beautiful principle of reversibility that has made the modern motor. To be sure in practice we have not one loop of wire, but several hundred turns, and we wind it on an iron core for the sake of increasing the magnetic effect, but the principle is the same; and just as the steam engine, forcing the armature coils through the powerful field of the magnet, generates the current that gives us light and power, so this current, driven through a precisely similar machine, forces it into powerful rotation. Almost simultaneously with the invention of the dynamo came the discovery that its action could be thus reversed; bu it was not until 1873, at the Vienna exhibition, that the possibilities of this discovery were realized. There is a fable, originating perhaps, from one of those beings who always like to imagine that discoveries do not come as the result of hard work, that this exhibition of a reversible dynamo the result of was an accident; but we, fortunately, have the word of M. Fontaine, who conducted the experiments, that such was not the case, and he has plenty of corroborative evidence in the previous enunciations of the principle of which we have just spoken. Suffice it to say that an electric motor was exhibited in 1873.

Nothing came of it except occasional applications until the keen eye of Dr. Werner Siemens, well known as the inventor of the dynamo that bears his name, saw all the possibilities of the motor for railroad use, and in 1879 the first modern electric railroad was built at the Berlin exhibition. Here for the first time a moving motor was supplied with power from a distant dynamo. The current was led to the motor car through a third rail and back to the ordinary track. Very shortly afterward the experiments began in this country, first, perhaps, in the hands of Mr. Field, and almost simultaneously at the laboratory of that incorrigible inventor, Edison. Two years more saw the opening of the Siemens electric road from Lichterfelde, a suburb of Berlin, into the outskirts of the city. Unless temporarily stopped, that road, the first practical electric road in the world, is running to-day. Of the developments of the last 10 years little need be said. They are known to all of you. The energies of a dozen inventors have been turned upon the problem, and it has been worked out with a rapidity amazing even in the swiftly developing field of electricity. But few except those actively engaged in the work have a realizing sense of the enormous difficulties that were encountered, difficulties a solution of which seems simple enough now but which stood as stumbling blocks in the road of progress even five years ago.

Given an electric motor and a car, how can they be combined? This was the first question to be raised. Where should the motor be put, and how should it be connected with the driving wheels? Almost every conceivable spot in and about a car had been tried as a place for the motor---on the platform, in the car, on top of the car and under the car, in almost any position that could be named. Not until the present method of swinging the motor from the car axle, so that the armature would be at all times equidistant from it, was devised, were thoroughly practical results secured. But the great difficulty in the way of using the electric motor is one which at first sight does not suggest itself---the high speed at which the motor ordinarily runs. It has been up to the present quite out of the question to build a light and efficient motor in which the armature should revolve at a low speed; I mean by that, 100 revolutions per minute, or something of the kind. With the ordinary motors running from 800 to 1,200 revolutions per minute, it is obviously absolutely necessary to reduce the speed by some kind of gearing in applying it to a car axle; for if this were not done the speed of the car would be preposterously great. Within the last ten years almost every known mechanical means for reducing speed has been applied to the problem; belts, chains, ropes, worm-gearing and every description of toothed gear has been pressed into service, but one after another has been discarded as impracticable, until at the present nearly all electric cars are operated by plain toothed gearing. In the existence of this lies one of the difficulties that must be overcome in the future.

Then, too, it was a matter of no little experimenting to find some way of conveying the electric current to the moving car. As we have seen, the earlier efforts were made with batteries on the car, but with the advance of the dynamo some sort of running contact had to be invented. As I just mentioned, the first electric road utilized the rails; but for street traffic this is inconvenient, and all sorts of overhead arrangements were schemed, experimented on and abandoned. Cars running on an overhead wire and dragged by wires from the car were and are still in use. Copper tubes slotted beneath were employed in which the car dragged along a wire brush much after the similitude of a gun cleaner. Then came every description of under running trolley from a wire broom that scraped and ground along the conductor to the present smooth running little wheel.

Then another snag was encountered. After the electric current is led to the car, how can it best be conveyed to the moving parts of the motor? The ordinary brushes such as we see on the commutators of dynamos answer the purpose admirably except for one inconvenient fact, that it is necessary to run the armature of a motor in more than one direction, as when the car is on the return trip, and the copper brushes that worked admirably well when the armature revolved with them raised a blazing protest when the armature revolved against them. If I were asked what is the most important minor improvement in electric traction, I should say unhesitatingly that it is the introduction of the carbon brush that rests quietly on the surface of contact and is quite indifferent as to the direction of rotation of the commutator beneath it. Aside from these fundamental difficulties minor ones were met at every point of the construction of an electric railroad. The trolley wire is necessarily under high tension, and only after elaborate experiments was the hard bronze wire now used found and adopted. Then this very tension brings a severe strain on the supporting poles, and all sorts of ingenious devices had to be invented to sustain and equalize it. The road that runs on your streets to-day is a result of an enormous mass of inventive ingenuity applied in directions of which it is impossible in a limited time to give any adequate idea. That the success which has been attained is so great is a standing monument to the perseverance and genius that have produced it. The electric car of 1890 is a machine that is marvelously successful, and in view of what is being done in every succeeding week, it is not too much to say that the horse's occupation in street car work is practically gone.

Now, let us look for a litttle at what can be done and glance at the probable lines of improvement. To-day the grinding gear wheels underneath the car constitute the most serious mechanical difficulty in electric railroading, and it should be the object of inventors to dispense with them, if possible. They rattle and grind and squeak, teeth break, bearings get hot, and there is no man who is practically acquainted with their manifold failings but heartily wishes them out of the way. It is possible, although it has not yet successfully been done, to build a motor of which the armature shall be directly upon the car axle, and that yet will operate with a fair degree of economy. This done and we should have a system of electric traction almost ideal in its simplicity; a single rotating armature grasped and centered between field magnets surrounding the axle, the current supplied to it from a movable contact, a switch to control it. That is all. And few people have any adequate idea of the mine of power that these same grinding cog-wheels waste. A question that is often asked is: Why is it necessary to put two 15 h. p. motors under a car of the same size that was previously drawn by a couple of mules. The question is a very pertinent one, though the answer is somewhat complicated.

In the first place, what do we mean by a horse-power? That is well enough known to most of you. We mean a power that is equivalent to 33,000 foot pounds per minute; in other words, a power that will lift 33,000 pounds one foot high in one minute, or one pound 33,000 feet high in a minute, or any similar combination of pounds and feet. Horse-power at best is a barbarous unit. The particular quantity I have mentioned was derived from ancient experiments on the tractive ability of horses. One important fact should, however, be borne in mind: that very few horses are equal to an output of an alleged horse-power for any length of time, but, nevertheless, can do work of considerably greater amount for a very short time, just as a man in a sudden moment of violent exertion can accomplish feats which he would be totally unable to perform continuously. So the two mules on the street car we have mentioned exert considerably more than two horse-power (or two mule-power) at the moment, for instance, of starting the car, but they could not exert that power continuously in dragging it. We are in the habit of estimating the power of motors in horse-power, counting it not directly, but in the unit of power known as the watt, and usually used in computing electrical work. The watts output of any given machine equals the product of the ampères by the volts. It is the unit of work, because in our modern system of electrical units the volt and the ampère are based on definite units of force, so that we can say with perfect certainty that one volt-ampère is equivalent to a certain amount of power, inasmuch as we have chosen the volts and ampères with that purpose in view. As a matter of fact, 746 watts make 1 h. p., so that we can readily compute the power of a given motor. In addition to the other failings of the horse-power as a practical unit, the same quantity is not meant by a horse-power in different countries. The French *cheval à vapeur*, for instance, is 735 instead of 746, so it has been suggested—and it is to be hoped the suggestion will be carried out in future practice - that work with power of all kinds should be estimated, not in horse-power, but in kilowatts; that is, in units of 1,000 watts—a little over the present horse power, and convenient in every way for computation. But this is a digression. Why is it that two 15 h. p. motors are necessary. In the first place, it has been found convenient to run electrical cars at a great deal higher speed than horse cars, consequently to employ more power. In the second place, electrical roads operate with very heavy loads on grades that are tremendously severe, as steep as one foot in ten. All this requires still more power, but does not explain fully the discrepancy between these 30 h. p. motors and the aforesaid two mules. When we come to examine the power which is required to operate electric car, taking the average of all day long, we find that the difference is not by any means so great. Somewhere from 3 to 6 h. p. is about the amount. A sudden spurt up a sharp grade will perhaps require half a dozen times this amount; and this is not disadvantageous, for a motor, like a mule, can, we see, pull very hard when it becomes necessary. But let us turn a little to experiments made with the view of answering the question I have raised. Most of our present electric cars have two motors, each with its appropriate set of gears, and it is an unfortunate fact that these two do not always pull together in the harmony that might be desired. There is a constant tendency for one or the other of them to do more than its share of the work, and, aside from this, the two sets of gears consume an outrageous amount of power, which, it should be remembered, does not go into any useful work but simply tends to heat and wear out the running parts. Experiments tried last winter in Colorado show the facts of the case very beautifully. A five-ton car operated with both motors at an approximate speed of 12 miles per hour required something like 6 h. p.; using only one motor, the horse-power required was reduced to five for about the same speed; and fiually, removing the pinion from one of the armatures, so that the car was operated by one motor and only one set of gears, the power was reduced to something like 3½, which, considering the load and the speed, is not at all too high. A pull of something like 20 pounds per ton is required on ordinary tracks; that is, the moters in this case were pulling 100 pounds at the rate of 12 miles per hour, which, reduced to foot pounds and then to horse power, becomes about 3, which gives the motor that actually exerted about 3½ horse power a very reasonable degree of efficiency. So the cost would not be at all bad with one motor either on the axle or simply geared. It is pretty clear that there is a disadvantage in the use of two motors except in so far as it is convenient to drive both axles for ease of ascending grades, and it is no less evident that a considerable power can easily be lost in gearings.

We should remember that certain losses in the motor cannot be avoided. In the first place, the current that drives the machine heats it by an amount which we can definitely determine. In the second place, the revolution of the armature sets up little electrical eddy currents in various parts of the machine precisely after the manner of a common dynamo. In the third place, still other power is used up in producing a class of magnetic reactions in the iron core of the armature, known as hysteresis. These necessary losses may easily amount to a horse power in an ordinary street car. So we may hope in the near future to have a system of motor cars in which considerably less power will be required than at present, and this by the simple though somewhat difficult process of simplifying the running gear.

But the possibilities of electric traction are by no means exhausted in its application to street cars. I do not hesitate to say—and I say it deliberately—that to operate an ordinary railroad train by an electric locomotive is a far simpler problem electrically and mechanically than the operation of the street cars here on the streets. The slow speed necessary for street cars is, as I have already said, a disadvantage in that it compels us to gear down the motor. In running at railway speed no such difficulty is encountered, for the four or five hundred revolutions per minute made by the drivers of an express locomotive is just about the proper speed at which an electric motor of corresponding power could be advantageously run. We should then be enabled to dispense entirely with the obnoxious gearing and to put directly upon the axle of the driving wheels an armature big enough and powerful enough to generate the required speed. Nor is there any practical difficulty in building motors big enough to do the work. There are plenty of 100 h. p. dynamos now running, and the increase of size sufficient to duplicate the power of a locomotive is the simplest sort of mechanical operation. I do not think there is a prominent electrical company to-day that would hesitate to take an order for a 500 h. p. machine and guarantee its performance. I certainly know of several that would be glad of the chance and would accomplish the task successfully.

There is no sort of difficulty in conveying the current to one of these big motors moving at railway speeds, for it has been established by experiment that the method of running contacts such as is in general use will work admirably up to the speed of 130 miles per hour, at which speed an electric car of respectable dimensions has been actually operated. The question, then, of using the electric motor for railway work is not a question of mechanical or electrical difficulties but of economy. It is worth while noticing that in an electric locomotive the big machines can be given an amount of care quite impossible on our street cars for the good reason that while the street car motor is exposed to the wet and dust and dirt to an enormous extent, in an electric locomotive the whole can be boxed up inside of a clean car and given practically as careful attention by the engineer as is now possible in a dynamo operated in a central station.

Now as to the question of economy. The steam locomotive, in its present stage of development, is a remarkably

successful machine. Nevertheless, it does consume more coal proportionately than is used, for instance, in the engines of a big steamship like the "Umbria" or the "City of Paris." It burns in fact between two and three times as much coal per horse-power of output. This is not due to any radical defects in the locomotive, which, all things considered, is a good and economical machine, but arises from the fact that the huge engines of the trans-atlantic liners are condensing engines, nearly always triple expansion, while the locomotive is a simple engine of a class that has been generally abandoned for steamship use. The principal advantage that we should gain by using large electric motors supplied from a central station instead of the present steam locomotives would be a much more economical use of coal. It is safe to say that the consumption of fuel for a given number of horse-power produced by big engines in an electric station could be reduced to less than half what is now used to supply a similar amount of power in the locomotive. To offset this advantage there is the necessary loss of power in conveying the current generated to the running motor. If the length of line to be operated from a single station is great, this loss may be considerable; but it is unquestionably smaller than the gain to be made in the way I have suggested. Beside this, the electric locomotive does not have to drag around its supply of coal and water.

There is, too, a magnificent possibility of economy in the use of water-power. Very many of our railroad lines follow the course of some river, winding in and out along a valley; frequently there would be an abundant supply of water-power near at hand, and under such circumstances the cost of operation for an electric road would become enormously less than for the same line operated by steam. Of course, this is under favorable circumstances, and therefore we should not lay too much stress upon it; but I think it is clear to any one who is familiar with the operation of big condensing engines that their advantage in economy over a locomotive is so great as to make it worth while to distribute the power from them, even at a considerable loss. The amount of copper line wire necessary for such distribution is not at all unreasonably great; no greater, in fact, than the amount now used in trunk lines for long distance telephony; and there is every reason to believe that, taking into consideration all these things, an ordinary railroad could be operated by electricity at a cost less, or at least no greater, than is now incurred.

As the speed to be attained rises, electric power gains over its competitor; for a high-speed locomotive must carry an enormous amount of coal and have a boiler of prodigious capacity; while inasmuch as we do not have to move the fuel or boilers of a central station, their size is a matter of indifference. The speeds that are reached now with locomotives can be duplicated with motors without difficulty. I believe the present record for locomotive speed is 87 miles per hour, made this year on the Philadelphia & Reading road, while last year, as I just mentioned, an electric car, small, to be sure, but at the same time running under some disadvantages as regards track, attained a speed of more than two miles per minute. In fact, economy aside, I do not see that we can set any limit to the running-speed of a motor except that imposed by adhesion, the strength of the steel in the flying drivers to withstand the centrifugal force and the conditions necessarily imposed on the strength and smoothness of the track.

But this aside, let us cast a prophetic glance forward to the electric express train of the future. It may consist of a motor car, very likely pointed at the front to lessen the resistance of the air to its swift passage, and containing one or more powerful motors directly on the axis of its drivers and aggregating perhaps 1,000 h. p. as a normal output. Following it the customary vestibuled procession of baggage cars, day coaches and sleepers of the ordinary size and number. Its only lights by night will be incandescent lamps; its only means of heating electric heaters distributed through the train; 10 or 15 extra h. p. are enough to furnish an adequate supply of heat. The track over which this train will run must be straight and smooth, not at all a marvelous track, but only such a one as the great English trunk lines possess to-day. A third rail or a strong bronze wire above will convey the current to the motors, and power for it all will be supplied by a series of stations perhaps 20 or 30 miles apart along the line. The train will start smoothly into motion, fly along the track at the highest rate of speed that is found practicable, and stop quickly and easily by applying its electric brakes. The system of distributing power can be easily converted into an automatic block system that will secure beautiful control of the trains and almost absolute immunity from collisions.

Of the possible speed to be reached I will not attempt to say much. I do not think, however, that 100 miles an hour is at all out of the question, for, as we have seen, nearly 90 miles an hour has already been made, and more than 80 is made for short distance by some of the regular express trains between New York and Philadelphia. But consider even what 100 miles an hour means: Starting from New York, Philadelphia before breakfast; going northward, Boston an easy morning's run, and finally perhaps Chicago a night's trip. All this may sound somewhat fantastic to those of you who have not followed the electrical progress of the last year; but such developments are not only possible but probable. It is not so much a question of whether it can be done, as who will be the first to accomplish it. It may not be for a decade, but unless some strange series of fatalities shall intervene, I see no reason why many of this audience should not take frequent rides on just such a train as I have endeavored to describe. The first attempt will surely be made ere long, and in the swift progress of electrical matters that first experiment, whether it should fail or not, will surely be followed with ultimate success. Ten years has seen the electric road pass froma plaything at which scoffers turned up their skeptical noses to an every-day necessity. Ten years more will see it pass from the street car of to-day to—who knows what?

The Association of Railway Telegraph Superintendents.

The ninth annual meeting of this association was held at Niagara Falls, N. Y., on June 18 and 19. The following members were present:

C. A. Darlton, President, Washington, D. C.; P. W. Drew, Secretary, Chicago; C. W. Hammond, St. Louis, Mo.; C. Selden, Baltimore, Md.; A. R. Swift, Chicago, Ill.; G. L. Lang, Boston, Mass.; G. C. Kinsman, Decatur, Ill.; G. T. Williams, Cleveland, O.; M. B. Leonard, Richmond, Va.; R. Stewart, Elizabeth, N. J.; A. Ramseur, Atlanta, Ga.; I. T. Dyer, St. Joseph, Mo.; U. J. Fry, Milwaukee, Wis.; H. C. Reed, Milwaukee, Wis.; J. B. Stewart, Weehawken, N. J.; M. Magiff, St. Albans, Vt.; W. J. Holmes, New York, N. Y.; W. W. Nichols, Chicago, Ill.; W. F. Taylor, Altoona, Pa., O. C. Greene, St. Paul, Minn.; W. E. Lewis, Long Island City, N. Y.; H. C. Sprague, Kansas City, Mo.; G. M. Dugan, Jackson, Tenn.; L. B. Foley, New York, N. Y.; C. S. Jones, Chicago, Ill.; A. R. Singafelt, Topeka, Kan.; E. A. Smith, Boston, Mass.; S. K. Bullard, Sedalia, Mo.; T. W. Stacey, Marshall, Tex.

Many ladies were also present. The first session of the meeting was called to order by President Darlton, on Wednesday at 10:35 A. M. After reading the annual report, the following new members were elected:

J. C. Ford, St. Paul, Minn.; W. J. Stonebromer, Two Harbors, Minn.; H. D. Milton, Texarkana, Tex; J. V. Goode, Kansas City, Mo.; P. H. Hough, La Crosse, Wis.; G. N. Gish, Marshallton, Ia.; H. B. Briggs, Redwing, Minn.; T. W. Parks, Tyler, Tex.; J. N. Miller, Dallas, Tex.; W. D. Hendrickson, Long Branch, N. J.; B. R. Pollock (the world's champion sender), Hartford, Conn.; L. Horton, Jr., St. Paul.

The following officers were elected for the ensuing year: George T. Williams, of Cleveland, president; George M. Dugan, vice-president; P. W. Drew, of Chicago, secretary and treasurer, was re-elected. M. B. Leonard, Charles Tilden and G. C. Kinsman were appointed a committee on time and place of next meeting.

As the attractions of Niagara are available only by daylight, it was decided to devote the afternoon to a tour along the American and Canadian shores of the falls and rapids, and substitute an evening session for that usually held in the afternoon.

The first paper of the evening, of which the following is an abstract, was read by Robt. Stewart, Superintendent of the Central Railroad of New Jersey, on the "History and Development of the Block System." Mr. Stewart was the first railroad telegraph superintendent to introduce this system of signaling in America. He was at the time connected with the Camden & Amboy railroad, over which nearly all the Eastern troops passed during the war. A rear collision, which occurred at Bristol, Pa., in the summer of 1863, causing the death of a large number of soldiers and the fireman of the engine, led to the investigation of an English Block system, at the request of Ashbel Welch, then president of the company, and Mr. Stewart was instructed to experiment with and put in use a signal, by which trains could be notified, without being stopped that the track to the next point was clear. After some experimenting, he placed in operation seven block stations upon the 25 miles of road, between Trenton and Kensington, using the banner signal, in conjunction with the regular telegraph offices. There were two fixed glasses, the upper two white, and the lower red, with two independent lamps, one for east and one for west bound trains, which were operated by hand, with a rope attachment. This arrangement proved defective, and a single lamp, with a movable red flannel shield was substituted. A record of the trains was kept on a board with pegs. The telegraph operators used the regular Morse system for notifying adjacent stations, that trains were in or out of the block. The experiment proved so successful that it was extended from Trenton to New Brunswick, covering 26 additional miles of road in 1864. Shortly after, upon the formation by consolidation of the united railroads of New Jersey, the system was extended to Jersey City, making it complete from Philadelphia to Jersey City, excepting between the cities of Newark and Jersey City. In 1870 a connecting road from Frankford Junction to Mantua was equipped, making a total distance of 90 miles. From the establishment of this system up to the date when the road was leased by the Pennsylvania Railroad, no rear collisions of any kind occurred, which he attributed to the fact that only the "positive" block was used, in distinction from the "permissive" block afterward introduced by the Pennsylvania Railroad, by which two trains were permitted upon a block at the same time by observing caution. In 1873 the P. R. R. began the introduction of the system to a limited extent, on the Pittsburgh division of the main line. Its extension was very slow until the winter of 1875-6, when it was rapidly extended over the entire main line. Its use was stimulated by the approaching Centennial exhibition, and in spite of the enormous increase of traffic, the protection was so complete that no accident occurred, which could be attributed to its failure. As originally introduced, the blocks were of considerable length, depending upon local conditions; but on the main line the distance varied from six to ten miles. The signal now used is the Standard Semaphore. The P. R. R. has now a continuous block system from Jersey City to Pittsburgh, and from Philadelphia to Washington, the most extensive in this country, also on the Northern Central division. The officers pronounce it a great success, and an absolute necessity to the road. On the C. R. R., of New Jersey, the electric pneumatic block signal system of the Union Switch and Signal Company was put into operation in April, 1890, between Jersey City and the Newark Bay draw, a distance of eight miles. The blocks ranging from 1,000 to 1,800 feet are operated on four tracks. At the commencement of each block, signal posts are erected, one for each track, carrying two semaphores. When the upper semaphore is at right angles, it indicates that a train is on the next block. When it projects in this way, the lower one is also set at "danger" or "caution," as the train leaves the block thus protected, the upper signal falls, but the lower remains at caution until the next block is passed and the train is two blocks distant. These semaphores are operated by pneumatic pressure, controlled by electricity. Those on one block are insulated from the preceding and following blocks. At the end of the block first touched by a train, the right and left hand rails are connected by a wire hung in circuit two cells of gravity battery. At the other end of the block the same rails are connected through an ordinary relay. When no train is on the block a current passes through this rail circuit holding the armature of the relay in contact, forming a circuit for the local battery. When a train enters upon the track its wheels and axles short circuit the battery, releasing the armature of the relay and breaking the local circuit, having a battery of eight cells. The local battery operating the semaphore magnet, when its circuit is closed forces open a valve which admits compressed air into the semaphore cylinder and the piston is driven down forcing the semaphore into the "safety" position. With the entry of a train upon a block the relay being thrown out of action the local circuit is opened and the semaphore is drawn by a weight into "danger" position. Where the "home" and "distant" signals are both operated under these conditions, the arrangement of circuits is more complicated. The supply of compressed air is furnished by a plant of compressors communicating by pipes with a series of reservoirs placed along the line at the foot of the signal poles, and pipes are connected from there to the semaphone signals. The ordinary ties are found to afford sufficient insulation for the rails, but the fishplate joints not being ample conductivity is re-enforced by iron wire connections. Between the blocks the rail ends are insulated.

Mr. Stewart then described the various systems of block signals which had been actually introduced, beginning with the Hall system which was first used on the eastern railroads in 1871, and has since been greatly improved. Other systems referred to were the Sykes, used on the New York, New Haven & Hartford, and the Black mechanical signal, the latter being used on the elevated railroads in New York and Brooklyn. Another form of automatic signals used in this country is known as the Union Switch and Signal Company's clock system, which has been introduced on the Boston & Albany, Old Colony, New York, Providence & Boston, and a number of other roads. In 1882 it was adopted on the New York and New England railroads.

The Chicago, Milwaukee & St. Paul Railway Company, has a block system in operation on 146 miles of their Chicago & Council Bluffs division, using double arm semaphores placed in a position to be seen from both directions. It is operated by hand in connection with an ordinary Morse telegraph.

The cable electric signal is being experimented with on the Staten Island Rapid Transit road.

The Chesapeake & Ohio Railroad use a system similar to that of the P. R. R., covering all tunnels and trains going down both sides of the Allegheny Mountains, using the Hudson semaphore signal.

The Chicago, Burlington & Quincy have practically three different systems in use, all non-automatic, the difference being mainly in the manner of connection between offices. The main line from Chicago to Pacific junction, 482 miles, is now operated, under what may be called the "permissive" block. The New York Central Railroad has begun the introduction of a pneumatic-electric system on that part of its track between Woodlawn junction and the Harlem River, the same as that used on the Central Railroad of New Jersey. The New York Central is also equipping fifteen miles of track near Poughkeepsie with the Hall system. The New York, Lake Erie & Western uses a block system on 232 miles. Other railroads using various block systems, are the Boston and Maine, Philadelphia, Wilmington and Baltimore, the Missouri Pacific, the Canadian Pacific and the Lake Shore Railroads.

A signaling system operating a visible and audible signal in the cable has recently been introduced by the Desart Electric Company, of Columbus, O. It is used on the Suburban road north of the Harlem River. Another electric block system is owned by the Pennsylvania Steel Company.

In closing his explanative paper, Mr. Stewart said that the system of blocking trains has and could be improved, and that the time is not far distant when upon all the main trunk lines of the country the business will have grown to such an extent that in order to move all trains at a higher rate of speed, especially freights, it will be necessary to locate signal towers at such distances as will permit the use of the "absolute" block to govern all their movements. Speed and safety were so closely allied in the successful operation of railroads, that whatever tends to their accomplishment the progress of the times would not permit to be ignored. If a simple and inexpensive automatic system could be devised for operation between the main block stations, a long step in advance would be taken. "Permissive" signaling might then be used with absolute safety at the main stations, as the auxiliary would act as an "absolute" intermediate block.

Mr. Charles Selden read a paper upon the increased adhesion between the wheels of a locomotive and the track caused by the passage of electricity, based upon the experiments and patents of Elias E. Ries, of which the following is an abstract:

From competent authorities on motive power, it has been determined that a locomotive, having a weight of 100,000 pounds, has a tractive power upon the rail, when in best condition, of but 25,000 pounds. And when the rail, by reason of the weather, is in bad condition, the tractive power amounts to only about what an engine of 15,000 pounds should have. In other words: on good rail, by non-adhesion, the locomotive gives but twenty-five per cent., and on bad rail, but eighteen per cent. of the power which, theoretically, should be had from it.

Efforts were made some fifteen years ago, by an Englishman named Wederman, to overcome the non-adhesion, by winding the spokes of the driving wheels with wire, thus making a magnet of the wheel, with the view of, by magnetism, attracting the wheel to the rail, thus increasing the friction, and, thereby, the adhesion to the rail on the part of the locomotive. Having but a primary battery, it is plain to be seen that the results were so slight as not to be appreciable. Another objection, even had the dynamo

been used, was that, in order to secure sufficient magnetism to be of benefit upon such an immense machine as a locomotive, the magnets would have to be very large, and the winding upon the spokes of the drivers would have necessitated a change in the construction of the engine, so that as the bobbin was being revolved by the wheels there would be room to clear the fire-box on the inside and the side-rods of the locomotive on the outside. This, of course, would render necessary a longer crank pin for the bars, and being longer it must necessarily be stouter in order to stand the increased leverage, so that a device of this character for the locomotive engine would not be economical, and would necessitate the reconstruction of all locomotives using it. This inventor filed patents in this country, and several others followed in his foot-steps, but nothing practical has yet been evolved from that method.

Recently Mr. Elias E. Ries, an American inventor, secured letters patent upon his method of increasing the adhesion of the locomotive to the rail by the use of electricity, and he took a wide departure from the path pursued by former inventors. Mr. Ries proceeded upon the hypothesis, that an electric current of large volume, if properly employed, could be used to weld metals. Acting upon this theory, he purposes to arrange upon a locomotive a dynamo of sufficient power to be run by a small auxiliary engine, and to pass the current from the dynamo to the driving wheel of the engine, along the rail to the next driving wheel, through its axle and the other wheel, to the other rail and back to the first driver, thence to the dynamo, thus making a local circuit, so to speak, which would travel with the locomotive, passing a current through the drivers and along the rail as indicated, and for this purpose, by a very simple method, he insulates one pair of the driving wheels. By this means the inventor proposes to cause an incipient weld between the driving wheels and the rails. I say incipient because the wheels being in motion the weld, if any, is being made and broken by the revolution of the wheels, therefore, a perfect weld is not obtained; nor, of course, would it be desirable except for brake purposes, as in descending a grade for instance.

If the theory advanced by Mr. Ries can be made a success, practically, it means a great many things to the railroad world. If by means of this invention the tractive power of a locomotive is increased, say, even 25 per cent., it means ten additional cars on a forty-car train. It means a large gain in the hauling capacity on high grade railroads. It means increased speed for passenger trains. It means a saving, indirectly, of fuel. It means the employment of lighter locomotives to do the same amount of work as the heavier ones, thus being easier on the road-bed and bridges. It means the mounting of grades that would not be considered as possible at the present time. All this, provided that in practice on a locomotive, the theories advanced shall hold good. . . .

Another feature of this invention is that it is not necessary to keep the current flowing all the time unless you need it: but when you stop the train and want to start it, your locomotive at that time not being in motion, a more perfect weld is obtained, thus enabling you to start at once, without slipping, and after you have gotten your train under headway, your current, if desired, may be switched off. So much for the pulling power and so much for the motor.

The statements made by Mr. Selden were questioned by Mr. Nichols, and a model motor and track were introduced to prove the assertions claimed by the inventor. The experiments made were entirely satisfactory and convincing to the most skeptical—the only question being as to the practicability and economy of the application on a large scale.

W. F. Taylor followed with a paper on "Lighting at Wrecks." After referring to the importance of powerful artificial lights to facilitate the clearing away of wrecks at night, Mr. Taylor gave a description of the electric light car used upon the Pennsylvania Railroad.

The car itself was an ordinary box car, having an end door with a small extended platform and windows. A 15 h. p. boiler is at one end, surrounded with water tanks of 800 gallons capacity. Near this is a coal box holding two days' supply of fuel. At the opposite end of the car is a 15 h. p. Westinghouse engine, making 300 revolutions per minute. Near the centre of the car is a 10-light Weston dynamo, making 1,000 revolutions per minute. Suitable receptacles are provided for tools, lamps, etc. On one side of the car two reels of wire are permanently fastened, one of which contains a wire that is run out as a feed wire, the other being connected to the last lamp of the circuit, and used as a return wire. The lead wires are connected with a brush which connects with the axles of these reels, thus giving a path for the current. Upon top of the car are carried tripods and tools for hanging the lamps The car is manned by a crew of one engineer and four linemen. In starting for a wreck the regular crew is always preferred as they are thoroughly drilled. Arriving upon the grounds the first thing is to locate the car; then determine the number and location of the lamps. Then a man is started out with the end of wire from the small reel, followed by another carrying pole, spike and hammer, or tripod, as required; then the third man with the lamps and a short section of wire, continuing till the last lamp is reached, when the wire on the larger reel is run out and connected with the last lamp, thus completing the circuit. The lamps are swung from the most available points, portable poles being used if necessary. These are usually made of 4 × 4 inch hickory, 18 feet long, with the lamp. At the bottom a piece of 1-inch gas pipe is clamped to the pole. To erect the pole a steel bar is driven into the ground, and the pole is then lifted up so that the gas pipe will go over the steel bar. In the bracket at the top of the pole is a pulley through which a rope passes and thus draws up the lamps. The pole is more easily handled than a tripod. The time occupied in starting up the lights is shown in the following instances: Wreck No. 1, seven lamps, three-eighths mile of wire, started in one hour; No. 3, seven lamps, one-half mile wire, 1½ hours; No. 4, six lamps, one-half mile wire, 35 minutes. The cost of equipping a car ready for service was about $2,500. In operation it costs about $1 per lamp per hour, but even if it cost $5 per hour it would be worth it.

Mr. Taylor gave descriptions also of the Lucigen and the Wells lamps, both of which used petroleum. The Wells light is now being used by the P. R. R. and both styles were in use after the Johnstown flood.

Papers were read by Mr. B. Leonard, on "Electric Lighting in Railway Service;" by George C. Kinsman, on "Train Despatching, its Uses and Abuses," and on "Correct Time, How Shall We Maintain It?" by Prof. H. S. Pritchett, of Washington University, St. Louis. The meeting adjourned Thursday evening to meet next year at Cincinnati.

There was a larger number of exhibitions than usual, among them being the Hall Signal Company, Edison Phonoplex System, Edison-Lalande Battery, Electric Secret Service Company, Pennsylvania Steel Company, Molecular Telephone Company, P. B. Delany, O'Neill crossing signal, the Desart Electric Company and the Brown Electric Protective Company, Philadelphia, Pa.

Board of Electrical Control.

There was very little business done at the meeting of the Board of Electrical Control on the 18th inst.

Application was made by the Subway Company for permission to construct subways for telegraph and telephone wires in Franklin street, from West Broadway to Centre street, and Centre street from Franklin street to Worth street; in Fourteenth street from University Place to Fourth avenue, to Thirty-second street, and to Lexington avenue; and on Eighty-sixth street from Lexington to Third avenue to 130th street.

The Commissioner of Public Works asked that such permits should be given on the condition only that no new pavement be disturbed, and that none of the paving operations now in progress be interfered with. Mayor Grant was quite in accord with this view, and the permits were granted conditionally.

Mr. Gilroy presented a report containing the names of streets already paved, or about to be paved, and recommended that all permits for subways in those streets that may already have been granted be rescinded. The electric light people strongly objected to this suggestion and wanted to know if certain streets would be exempted where the work of the companies had been delayed very considerably through no fault of their own, thereby putting it out of their power to push forward. The Mayor refused to make any exemption, and a resolution was passed revoking permits in such streets as are already paved, and in such streets or portions of streets as are in course of paving, "as per list to be furnished by Mr. Gilroy to the secretary of the board not later than to-morrow."

The Mayor said that in his opinion the poles and wires on all these streets should be cut down, but the matter was not pressed.

Police Commissioner Voorhis made an urgent appeal for a separate duct for the wires of his department. He maintained that if an attempt were made to crowd those wires into the same duct as the wires of the fire department, abrasion and consequent bad service and general dissatisfaction would be the result.

Commissioner Ridgway, for the Subway Company, contended that these premises were inaccurate, and proved that six ⅞ to ¾-inch cables are now being used in a duct with perfect effectiveness, and there is no trouble in putting them in. Mr. Bowen confirmed this view, and said that the real difficulty lay in the fact that the lion did not want to lie down with the lamb; the police department wanted a house of its own.

The Board decided that all the wires should be put together, but that if the exigencies of the police department eventually called for more room it should be given.

A motion was made requesting the representative of the Subway Company to report at the next meeting of the Board as to the actual work done, the number of streets in which the work is completed, and future operations.

There was some expectancy that the report of Chief Engineer E. W. Birdsall, Engineer Horace Loomis and Gen. Roy Stone, Inspector of Street Openings, on the gas explosion of the 12th inst. at the corner of Broadway and Fulton street, which had been made to Mr. Gilroy, and by him transmitted to the Mayor, would be discussed by the Board, but no action was taken. The report says:

"After sifting all the statements the commission expresses the opinion that the cause of the accident can be traced directly to the action of the New York Steam Heating Company, whose excavation had been open so long that it had caused the joints of the gas mains to open, allowing the escape of gas in large quantities, and to the failure to properly support the drip attached to the gas main in the first instance, and to the final breaking of the same by dumping a cartload of dirt upon it."

The report concludes, after making sundry recommendations:

"Unless these suggestions for the control of the steam heating company's pipes shall be consented to by the company, steps should be taken for the revocation of the company's charter or franchise on the ground that the company's business as now conducted is a common nuisance, prejudicial to public health, destructive to property, and actually dangerous to life."

The Lights Used by Parisians.

M. Hippolyte Fontaine has recently made an extended investigation of the amount of candle power used in Paris during the past thirty-five years. His figures show an enormous growth in the total light consumed, while in detail there is seen a diminution of candle and vegetable oil light, an increase in mineral oil and gas (though this increase is now halting) and a very great growth in the use of electricity. The following table gives the total candle hours per annum per inhabitant.

Year.	Candles.	Vegetable oils.	Mineral oils.	Gas.	Electricity.	Totals.
1855.....	220	1,174	.....	2,376	....	3,765
1872.....	250	967	503	4,272	....	5,992
1877.....	210	770	722	4,776	65	6,543
1883.....	217	649	1,214	6,087	230	8,427
1889.....	190	517	1,995	6,470	2,130	11,302

It will be seen that since the general introduction of electric light (1883 to 1889) the use of oil and gas has hardly increased at all, while the use of electricity has grown tenfold in six years. It is safe to predict that another six years will inaugurate the decadence of these modes of lighting, which, no doubt, would have followed the course of the obsolescent candle, had not a great growth in the demand for light in general followed the adoption of electric lighting.

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York. June 21, 1890.

The Edison Electric Illuminating Company, of New York City, has made application to list $2,000,000 first mortgage five per cent. bonds on the New York stock exchange.

The Hine Eliminator Company has just filled an order for six eliminators from the Western Electric Company of Chicago, this being the third order it has received from that establishment for this apparatus, an evidence that merit has its just reward.

Roovers Bros., 36 and 38 Bridge street, Brooklyn, are doing a very creditable business in the manufacture of light electrical and mechanical goods. They are making a specialty of coin-actuated machinery and are manufacturing a great variety of apparatus of this kind.

W. S. Bigby, 36 to 38 Bridge street, Brooklyn, N. Y., maker of models for electrical and general experimental work, is now building some motors for electric cars. He is constructing at present six motors for the River and Rail Electric Light Company, of 45 Broadway, New York city.

The Field Engineering Company, 15 Cortlandt street, has completed the laying of 200,000 feet of interior conduit for the Detroit Electric Light and Power Company. This was erroneously stated in our last issue to have been only 40,000. The current will be switched on to the new conduit wires about July 1.

The insulating material known as "Fibrone," which is manufactured by the Fibrone Manufacturing Company, 35 Warren street, has been recently submitted to the Merchants and Manufacturers' National Laboratory in this city, where it has been analyzed and pronounced an excellent substitute for hard rubber. This substance is made in sheets or other forms which can be sawed, drilled and turned with ease.

The New York Safety Insulated Wire and Cable Company, 234 West Twenty-ninth street, has just brought out a new and handsome braided wire covering for protecting outdoor lines from the abrasion caused by rubbing against trees and rough surfaces. There is a growing demand for such protection, and this new method of braiding serves the purpose admirably, as well as being alike unique and attractive.

Mr. David Evans, of the Baxter Motor Company, and superintendent of the works at Baltimore, was in town this week and states that, although it is only some three months since the reorganized company began operations, such progress has been made as to necessitate the trebling of its force of workmen. The New York representative of the Baxter Company is Mr. David Murdock, who reports a brisk demand for this well known motor.

The electrician's tools, it is said, are of more importance than his knowledge in the production of a successful piece of apparatus, and for this reason the American Saw Company, of Trenton, N. J., is doing a good work in offering to electrical engineers its excellent line of machine tools. Mr. C. Upham Ely, who is president of this company, is also engaged in the smelting and refining of nickel, at 35 Dey street. The new open circuit battery which Mr. Ely is putting upon the market has proved a great success.

Bernard Dreyfuss, 79-81 Duane street, New York city, is now doing a very large business in the manufacture of various styles of "adamite" trimmings for electrical goods, and reports that he has upwards of 300 workmen employed in the production of this class of goods. He has a well equipped shop, employs skilled workmen, and uses only the most improved machinery, and thus has the facilities for turning out large or small orders with equal readiness, and is not obliged to charge extra prices for specially-shaped dies.

The Seely and Taylor Manufacturing Company is rapidly getting its new offices into shape. It occupies two large floors extending through from 24 Cortlandt to 19 Dey street. This company does construction work of all kinds, lays underground and submarine wires and cables, builds electric light and power stations, and is thoroughly equipped for all work in these and kindred lines. The rapid growth of this concern is owing largely to the activity, enterprise and skill of Mr. John A. Seely, the general manager.

Manager F. Straus, of the Royal Silk Manufacturing Company, 2 and 4 Stone street, New York City, is doing a nice business in the manufacture of silk machine towels manufactured especially for cleaning all kinds of machinery. These articles are designed to be a safe and economical substitute for cotton waste, rags, hemp, and other materials now used for the removal of oil and dirt from all kinds of machinery, and are found of especial use in cleaning commutators or other parts of dynamo electric machines. One gross of these towels is said to compare favorably in use with 200 pounds of cotton waste.

Charles A. Schieren & Co., 45-51 Ferry street, have received a gratifying testimonial from the superintendent of the Utica Belt Line Railroad, at Utica, N. Y., as to the superiority of the five double electric perforated belts which they recently furnished to that company. These belts, although required to perform a difficult service in electric railway work, have given excellent satisfaction. Mr. Schieren claims that the perforated belts run with less tension than the unperforated, and for this reason will better adapt themselves to the requirements of electric street railway work in which changes of load are frequent, and usually occur very suddenly.

The manufacture of electrical goods is every day receiving more and more attention from large manufacturers of miscellaneous goods in and about New York city. The Consolidated Fruit-jar Company, whose large factories in New Brunswick, N. J., extend along the river front for several blocks, is pushing into the field of electrical manufacturing with all of its accustomed vigor, and is now ready to turn out almost anything from a bit of one ampère fuse wire to a frame for arc lights. Switches, cut-outs, sockets, shade holders, fuse wire, etc., are a few of the articles made. This concern also turns out some very nice specimens of finely-finished moulds, and makes a speciality of these for battery jars and glass work for the electrical trade. From its large foundry it turns out brass, iron and white metal castings by the car load. The company also owns its own plating department, and turns out in addition some of the most artistic bronzes known to the trade. A large number of novelties are now being manufactured for the leading electrical supply companies of the country.

The Crocker-Wheeler Motor Company, of this city, has good reason to be proud of the perfection of its "baby" motor. This beautiful little machine, which is intended for small ventilating outfits, sewing machine or other work requiring light power, and which is made for either constant potential or constant current circuits, is as perfect in all its parts as a 25 h. p. motor. It even has self-oiling bearings, as complete and as carefully constructed as those of the largest dynamo. Prof. Crocker says he could sell a

thousand of these motors in a few weeks if the company's factory could turn them out rapidly enough. He also says that he has not been able to find a complete and perfect steam engine, which is not a toy, of less than 12 h. p., a striking contrast with the perfection attained in this little motor.

Mr. George B. Prescott, Jr., general agent for the Kerite wires, has compiled and issued a handsome pamphlet containg price lists and miscellaneous data concerning the various styles of cable popularly known as "Day's Kerite." The pamphlet is handsomely illustrated with about 65 cuts, showing the various kinds of insulation for telephone, telegraph and electric light cables, and also contains a fund of information upon the dimensions, weights and resistances of copper wires. Mr. Prescott, who has had 14 years' experience in the electrical industry, has given his personal supervision to the compilation and arrangement of the pamphlet, and has done himself great credit in producing not merely a price list but a really valuable set of tables and other data concerning wires and cables for electrical purposes. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
No. 146 Franklin, corner Congress St.
BOSTON, June 21, 1890.

Mr. C. W. Holtzer, who was injured some weeks ago, is able to be out of bed and is improving slowly.

Bridgeport, Conn.—The De Oxidized Metal Company is building its own mills and will soon be ready to draw its own wire and roll its own metal.

The Eastern Electric Cable Co., 61 Hampshire street, Boston, has paid its regular semi-annual dividend of three per cent. on the preferred stock.

At a meeting of the stockholders of the New England Electric Safety Company held in this city, M. Grant was elected president and Mark Lewis, treasurer.

Torrington, Conn.—The local electric light company has two 650-light Westinghouse dynamos in operation, and has customers for 1,100 incandescent lights out of 1,300 total capacity.

The Thomson-Houston Electric Company's common stock is in the hands of something over 1,000 holders. It is said that the bidders for the pooled stock have until July 5 to complete the trade.

Guilford, Conn.—I. S. Spencer's Sons are manufacturing some pretty designs in brass castings for push buttons, electroliers and shade holders. They are receiving some very nice orders from the electrical trade.

H. E. Swift and Company, manufacturers of electrical supplies, have removed their factory from Sudbury street, Boston, to 36 Oliver street, where they will have increased facilities for carrying on an already large business.

West End electric car drivers have held a meeting for the purpose of taking action toward requesting an advance from two dollars to two and a half per day. The conductors on the electric cars will make the same demands as the drivers.

The Brown Protector Company, of New England, signed contracts last Monday with the Gamewell Fire Alarm Company for the exclusive use of the Brown protector on all fire alarm and police signal boxes throughout the United States.

Ansonia, Conn.—A suit has been brought by Mrs. Richard Conway, of Ansonia, Conn., against the electric road for $500 damages for injuries received while riding on one of the company's cars last winter. The injuries were received in a collision.

The West End Street Railway Company, now operating a large percentage of its entire equipment by electricity, has declared a semi-annual dividend of four per cent. on the preferred and of five per cent. on the common stock of record, June 14, payable July 1.

The Sessions Foundry Company, of Bristol, Conn., is building a large addition to its factories. It has lately added an overhead power crane, and has four cupolas in operation. This company turns out about 35 tons of metal a day, probably as large an amount as any foundry in New England.

The Thomson-Houston International Electric Company held its annual meeting at Portland, Me., on the 18th inst. Some changes were made in the Board of Directors Those chosen at the election were: Oliver Ames and Geo. W. Davenport, of Boston, and C. H. Newhall, J. M. Smith, B. F. Spinney, J. S. Bartlett and F. S. Pevear, of Lynn, Mass.

New Bedford, Mass.—Seventeen members of the New Bedford city government were in Boston on the 18th inst. inspecting the municipal signal system. The party was in charge of A. H Chapman, and, after looking at the apparatus in the signal company's office on Franklin street, was driven to several police stations to witness the practical working of the system.

The National Pipe Bending Company, of New Haven, Conn., is to build a new factory. The company sold 48 feed-water heaters last month, 13 of them to electric light stations. It has received further orders for one 150 h. p., two 100 h. p., three 300 h. p., one 80 h. p., two 200 h. p. and one 1,000 h. p. from electric companies. It is also sending its heaters to South America and the West Indies.

The Standard Electric Time Company, of New Haven, Conn., has just installed a time plant in the residence of Geo. C. Hood, a coffee broker of New York, at Lawrence, Long Island. This company is also sending a large number of clocks to Canadian points. Its pocket battery gauges are meeting with a very large sale, a recent heavy order having been received from the Central New York Telegraph and Telephone Company.

South Boston residents are not satisfied with the horse car accommodations with which they are now served by the West End Street Railway Company, and are anxious that the electric system be extended as soon as possible to that section of Boston. Although upward of 1,000 poles for the electric lines have been set in South Boston, President Whitney recently stated that the electric system could not be put in operation on those lines this year.

The Society of Electrical Engineers at Lynn, Mass., which is under the direction of Lieut. J. B. Cahoon, superintendent of the expert and car construction department of the Thomson-Houston factories, will be provided with a hall, with a seating capacity of 300, on the upper floor of the new office building. There are over 70 experts and foremen enough to make a membership of 100 in the society, which discusses purely technical subjects.

The Jewell Belting Company, of Hartford, Conn., has recently doubled the capacity of its tanneries at Jellico, Tennessee, owing to the increased demand for its short-lap oak belting, and is contemplating additions to its tanneries at Rome, Ga. Several thousand dollars have lately been expended at Hartford in adding new machinery in the coloring, currying and stretching departments, and further machinery and power presses will be put in shortly.

Lynn, Mass.—A new factory is being built by the Thomson-Houston Company on Centre street, which will be devoted to an entirely new use. Charles J. Vandepoele, the electrician whose railway inventions are controlled by the company, has for two years been working on electric mining machinery, and has developed his apparatus so that most of the inventions are already covered by patents, and application has been made for others. The new factory will be used for the manufacture of electric drills and other devices.

T. H. Brady, of the Brady Mast Arm Company, New Britain, Conn., is at present suffering from a severe attack of dumb ague, and will probably go to the Adirondacks for a month or so. This is unfortunate at the present time, as Mr. Brady has under way a new factory of two stories and basement which he is very anxious to complete, owing to his constantly increasing business. The new storm pulley, lately put on the market by this company, is a very simple and excellent device. It has also just issued a new and attractive catalogue calling attention to its specialties.

Massachusetts Supreme Court Decision.—The full bench of the supreme court has decided in the case of John C. Wilson vs. the Martin-Wilson Automatic Fire Alarm Company that, under the Statute of 1884, Chap. 285, a court of equity has authority to order a conveyance of a debtor's property by a master or other person appointed for that purpose, whenever it may be deemed necessary or proper in order to apply it to the payment of a debt conformably to the statute, and also that a patent right is not property situated in another state in such a sense as to deprive the court of jurisdiction to make the decree which was entered in the superior court.

The Eastern Electric Light and Storage Battery Company of Lowell, Mass., chartered in November, 1889, was organized for the purchase of patent rights of the Sorley storage battery for the territory of New England, and since that purchase it has bought the one-fourth interest which the Anglo-American Company of New York held in the Eastern Electric Light and Storage Battery Company. Increasing business, it is said, made it imperative that the company should be in a position to thoroughly equip electric light plants, and with that end in view propositions were made to the firm of L. H. Derby & Company, electricians, at Lowell. The negotiations resulted in the purchase of the entire plant, and the firm, consisting of L. A. Derby, F. A. Derby, and C. F. Morse, has entered the employ of the Eastern Electric Light Company. The company will remove about July 1 to larger and more commodious quarters, now being fitted up at No. 37 Market street, Lowell. Besides doing a general electric installation business the company is the agent for the "Connecticut" motor. L. H. H.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
465 The Rookery, Chicago, June 21, 1890.

Mr. P. C. Burns, manager of the Findlay Glass and Carbon Company, Findlay, O., was among the visitors to Chicago this week.

The Illinois Anglo-American Storage Battery Company has removed its office to rooms 23 and 24, 177 La Salle street, in this city.

Mr. La Fayette Cole, the Knight of the Knobby wire, gathered in some handsome orders for Holmes, Booth & Haydens during his trip to the West this week.

The Findlay Glass and Carbon Company's Chicago representative, Mr. Chas. H. Cone, has secured orders for some 10,000 cells of its open circuit battery during this month.

The Joliet Electric Clock Company has been organized at Joliet to manufacture electric clocks; capital stock, $5,000; incorporators, John Anderson, O. B. Bensen and Charles Anderson.

Mr. D. A. Andrews, Jr., of Pettingell-Andrews Company, Boston, left for Detroit and the East on Tuesday last after having satisfactorily arranged for the handling of the various specialties manufactured by his company.

H. B. Cobb, president of the Cobb Vulcanite Wire Company, of Wilmington, Del., and inventor of the underground system of electric wires adopted last Saturday for the South Side in this city, left on the 18th inst. for the East.

The Nowotny Electric Company, of Cincinnati, O., is having a large number of calls for its "Diaphragm" dry battery for telephone, electric bell and other open circuit work. This battery is attracting considerable attention, and is meeting with great favor.

Mr. H. P. Lucas, the active general manager of the Syndicate Investment Company, stopped over in Chicago for a day en route from San Antonia, Texas, to St. Paul, Minn., where he has established his temporary headquarters, but which are soon to be removed to Chicago.

The Reliance safety water columns have recently been adopted by the following electric light stations: Brush Electric Light Company, Indianapolis, Ind.; Canton Electric Light Company, Canton, Ohio; Mutual Electric Light Company, Alliance, Ohio; and the Fort Wayne Electric Light Company, Dallas, Texas.

The Great Western Electrical Supply Company, 190 and 192 Franklin street, has secured from Holmes, Booth & Haydens some forty thousand dollars' worth of underwriters', K. K., weather proof, magnet, and office wires, and of the various sizes of brush copper, and is thus prepared to fill orders for any quantity of these goods on short notice.

Mr. P. C. Ackerman, the general sales agent of the American Electrical Works, stopped over in Chicago this week and secured an order from the Knapp Electrical Works for several tons of its various wires. Mr. Ackerman expects to make it pleasant for the delegates who may visit Cape May this summer, and states that a large attendance is expected.

Mr. F. B. H. Paine, the Denver (Col.) representative of the Westinghouse Electrical Company, has been in Chicago this week arranging for a quantity of supplies, etc. Mr. Paine is making a specialty in his department of the transmission of electric current over long distances to motors used in the working of mines that in many cases have heretofore been deemed too inaccessible for profitable handling of the ores.

Capt. C. C. Chadwick, of Detroit, Mich., has secured the contracts for equipping certain trains on the Union Pacific Railway and on the Denver & Rio Grande Railway, the famous scenic line of the world, with the Parrish & Peck signaling system. On the Union Pacific the tests were carried on continuously for only fifteen days, after which the old bell cord was ordered taken off and the new system adopted.

The Knapp Electrical Works, 54 and 56 Franklin street, Chicago, are fortunate in having secured several hundred tons of copper wire before the late rise, an increase that is merely a forerunner to stiff prices that will probably be maintained throughout the year. Therefore, the wise purchaser will lay in a goodly stock of such sizes as will be required during the next five months, and thus save at least a cent or two per pound. In the line of incandescent lamps they are carrying the usual heavy stock of the Perkins type that has gained such an enviable record for long life without blackening.

Telephone Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$298@$300	Cumberland	$ 59@ $60
Central Union	69@ 70	Wisconsin	116@ 117
Michigan	98@ 99	Bell of Missouri	140@ 145
Great Southern	30@ 32	Iowa Union	21@ 23
Colorado	38@ 40	Missouri and Kansas	54@ 55
Rocky Mountain Bell	40@ 45		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$104@$105	Chicago Edison Co	$125@$130

The Electrical Supply Company, 171 Randolph street, Chicago is having a most encouraging trade in its well known high grade of fuse wire, which is drawn with careful exactness by the aid of steel dies. As soon as these dies show the least sign of wear they are cast aside and new ones secured, notwithstanding the heavy expense entailed, thus insuring a perfect uniformity in the respective size of the wire not otherwise attainable. This is a feature highly appreciated by all central station men, who have found that some of the fuse wire now on the market is little else than soft wire solder, extremely irregular in size. They also have found that this irregular wire sags down in the centre between the points of attachment and unless the weight is enough to break through the film of oxide it holds together. So, also, if it sags till it touches the base it does not "blow." When the wire is from three-quarters to one-half inch in length it melts, is held in the oxide coating and becomes red hot without interrupting the current. The liability to danger that is incurred when using this inferior grade of fuse wire is quickly apparent to all.

The Central Electric Company, 116 and 118 Franklin street, Chicago, is sending out a little pamphlet, entitled "Electrical Development," that gives a good insight into the surprising growth of its business, contains a biographical notice of the members of the company, and concludes with this artistic poetical effusion in which the arc light, the telephone and telautograph are quaintly referred to:

In olden time along the street
A glaring lantern led the feet
When on a midnight stroll,
But *now* we catch, when night is nigh,
A piece of lightning from the sky,
And stick it on a pole.

Time was when one must hold his ear
Close to a whispering voice to hear,
Like deaf men, nigh and nigher,
But *now* from town to town he talks,
He puts his nose into a box,
And whispers through a wire.

One time to Uncle Sam we went,
And gave our letters to be sent
And trusted to his care,
But *now* as quick as one can think,
We write it down with lightning ink,
And when its here, its there.

The Western Power Construction Company has been organized by Chicago capitalists, with a paid up capital stock of $500,000. Its specialty will be the complete installation of steam plants for electric light, railway duty and other power purposes, and the field of operation it proposes covering is all the territory in the United States west of the Alleghany Mountains. The policy of the company will at all times be "not how cheap, but how good," and it will endeavor to inculcate and foster the idea among its patrons that perfect workmanship in the installation of their steam plants simply means an increase in dividends. Every detail of a power installation will be contracted for and carefully supervised, and there will be no division of responsibility, this company assuming everything from the beginning to the completion of the contract. The McIntosh & Seymour engine, the high reputation of which for economy and efficiency is so firmly established, will be used by the Western Power Construction Company, and also such boilers, furnaces, etc., as may be called for in the contracts, if in keeping with the high grade of work it proposes doing. The company having absorbed the interests of J. A. Grant & Co. in the West and W. P. Adams & Company, Mr. Waldo P. Adams becomes the general manager of the new corporation. Mr. Adams' extended experience in the electric lighting field, since he has represented the Thomson-Houston Electric Company in various sections of this continent, and his broad, clear-minded views regarding the ultimate magnitude of the electrical industry unquestionably insure success to the company, as is well indicated by the fact that during the first week of the company's existence, Mr. Adams closed contracts for over 2,600 h. p. of engines, Mr. James E. Wilson, formerly with H. A. Glasier, and later a partner in the firm of W. P. Adams & Company, takes an active interest in the new company, and they have secured the services of Mr. Charles S. Colson, a gentleman thoroughly familiar with all the details of extensive steam plants, having for ten years been engaged in steam plant construction, and having installed for the Babcock & Wilcox Company the 1,000 h. p. plant ordered by the Chicago City Railway Company, and the 3,000 h. p. plant for the cable railway system at Los Angeles, Cal. Mr. Colson will be a valuable acquisition to the company. The Western Power Construction Company, in order to be at all times easily accessible, has established its headquarters at 144 Adams street, on the ground floor of "The Rookery." F. DEL.

SOUTHERN NOTES.

NORFOLK, VA., June 19, 1890.

Salem, Va.—A telephone line will soon be in operation between Salem and Roanoke.

San Antonio, Tex.—By a recent election it was decided to expend $25,000 on a fire-alarm system.

Decatur, Ala.—The Electric Light and Power Company contemplates the addition of a new dynamo.

Baltimore, Md.—The Southern Electric Company has sold its electric plant to the Maryland Electric Company.

Roanoke, Va.—The Roanoke Power Company, recently organized, is in the market for an electric equipment.

An Electro-Chemical Plant.—The Electro-Chemical Amalgamating Company, of Hot Springs, Ark., has erected an experimental plant, at Bear, Ark.

At Waxahachie, Tex., the newly incorporated electric light company has contracted with the Heisler Electric Light Company of St. Louis, for an electric light equipment.

Point Pleasant, W. Va.—The electric light and power company has sold its plant to G. E. Milligan, of Parkersburg, who contemplates an enlargement of its capacity.

Roanoke, Va.—The telephone system, which was commenced with 35 patrons, has steadily increased under the excellent management of Mr. R. L. Wright, and last week the 112th connection was made.

Savannah, Ga.—A syndicate composed of Messrs. I. T. Rhea, B. S. Rhea, Thomas W. Wrenne and J. H. Fall has purchased the entire street railway system, and will equip it with electric power. These parties are the ones who recently acquired control of the electric street railway of Nashville, Tenn.

Manchester, Va.—Mr. A. H. Rutherfoorde and Mr. A. Langstaff Johnson will decide in a few days upon the site of the location of this company's electric plant, which is to furnish electricity for the street railway now being constructed by the Southside Improvement Company. The electric cars on this line are expected to be in operation by the first of July.

A Fire Alarm Competition.—The city council of Wilmington, N. C., has been trying for some time to decide what to do in reference to the fire alarm system of that city. Mr. Gamewell, one of the owners of the Gamewell system, now being operated in that city, is now in Wilmington, looking after the interests of his company. His company recently made a proposition to the council for the sale of the present plant to the city, but the fire committee, considering the price too high, has invited propositions from other companies for the establishment of the new system, as the Gamewell people spoke of removing their plant. The matter, however, may be satisfactorily arranged before Mr. Gamewell takes his departure. The Gaynor Electric Company, of Louisville, Ky., has submitted a proposition to put in a new plant, and the Interstate Fire Alarm Company, of Omaha, Neb., has also a representative on the ground, in the person of Mr. T. R. Polglase, who is secretary and manager of the company, and who is carefully looking out for his company's interests. It is stated that a fine impression has been made by an exhibition of his apparatus and system. Y. N. B.

ENGLISH NOTES.

(From our own correspondent.)

London, June 11, 1890.

The Central London Electric Railway.—An attempt was made last week in Parliament to defeat this scheme, but I am glad to say it was a complete failure.

Municipal Lighting.—Last week the Board of Trade granted provisional orders to some 40 municipal authorities and the bills confirming these orders are now before Parliament. Now that these orders have been obtained the question is in the words of the well known advertisement, "what will they do with them?" The Vestry of St. Pancras (one of the largest metropolitan districts), which, as your readers may perhaps recollect, decided to make use of a Provisional order, which it obtained some six years ago, has obtained permission to borrow £10,000 and has invited tenders for the immediate erection of a 10,000 light station. The corporation of Swansea, which obtained an order last autumn, also invites proposals from electric lighting companies for the execution and maintenance of plant to supply the borough. The corporation of Bristol is also about to make use of an order granted to it some six years ago, and, judging from the tone of the speakers at a recent meeting of the corporation, it would seem as if they were in earnest in this direction and meant to supply electricity to a large area, as soon as possible. It will thus be seen that one or two municipal authorities have already begun genuine work.

The Meeting of the Institution of Electrical Engineers at Edinburgh.—The Institution of Electrical Engineers will hold a three days' meeting at Edinburgh in the middle of July in connection with the electrical exhibition now open there. The date fixed for the meeting is somewhat early, and the greater portion of the prominent members of the institution will find it difficult to go so far before the ordinary vacation season sets in. It is, however, to be hoped that the attractions of the exhibition and the neighborhood, and, perhaps, the generosity of the large railway companies, will result in a sufficiently large and representative assemblage. Amongst the papers to be read will be one by Prof. Ayrton on accumulators in which, I believe, he will deal at some length with the vexed questions of their efficiency. A paper will also be read on the electrical exhibits at the exhibition. Although the electrical industry in England is certainly more in need of advertisement that it is with you, I am afraid the English electrical engineers will not be able to persuade themselves to pay their visit to Edinburgh in state in a special train, as was done at the recent meeting of the National Electric Light Association in Kansas City.

Interurban Telephonic Communication.—Side by side with the gradual development of electric lighting and electric traction in this country, the use of the telephone continues to grow. At the present moment the chief telephone companies are devoting their energies to the completion of an extensive network of trunk wires. The large towns in the busy industrial districts in the north have long been well provided with interurban lines and within the last year or two the company which serves Wales and the west of England, although it has by no means a very promising field, has spent close upon £40,000 upon trunk wires. Up to the present the metropolis has been practically isolated in this respect, the only interurban line it possesses being that to Brighton, which is by no means a satisfactory one. We have, however, long been promised connection from the north and the south, and I hear that this promise will really be fulfilled within the next few months. With regard to the western counties system it is interesting to note that although it does not cover a particularly busy or rich district, the number of interurban calls is now at the rate of about a quarter of a million a year. The gross receipts from this source already amount to six per cent. on the original outlay, and as both the number of calls and the receipts are rapidly increasing, it would seem as if the trunk system is going to confound the prophets and prove a paying business *per se*.

THE TELEGRAPH.

The House Committee on Post Offices and Post Roads has postponed the further consideration of the Postal Telegraph bill until next session.

Buffalo, N. Y.—An order has been issued by the general manager of the Lackawanna Railroad requiring all telegraph operators either to leave the service of the road or sever their connection with the order known as the Railway Telegraphers' Union.

The American District Telegraph Company of Minnesota, with headquarters at Duluth, has filed corporate articles with the secretary of state. The company has a capital stock of $50,000. The incorporators are Henry C. Hope, William H. S. Wright, James B. King, Samuel B. McConnell, Samuel Dearing, Salon L. Perrin of St. Paul, and George C. Howe of Duluth. The general nature of the business will be the construction and maintenance of telegraph and telephone lines, pneumatic tube lines and subway conduits in Minnesota.

The Essick Printing Telegraph Company has had representatives in Pittsburgh, Pa., and negotiations have been in progress for some little time. It is believed the departure will be hailed with pleasure by users of the telephone in towns surrounding Pittsburgh, as the Essick method of communication is very satisfactory. Mr. Abner McKinley, brother of "the little Napoleon" of the House of Representatives, is a leading spirit in the movement. Mr. Eagye, of Johnson, Eagye & Earl, one of our largest wholesale grocery houses, is one of the leading stockholders.

The Western Union Telegraph Company's net earnings, over interest and sinking fund, for its year—July 1, 1889, to June 30, 1890—are $6,364,982, against $5,382,372; increase, $982,610. Dividends, $4,955,995; increase, $646,458. Surplus, $1,408,987; increase, $336,052. Thus, while the company will have paid for the year to end June 30, 1890, five and three-fourths per cent. dividends, its earnings will be equal to nearly seven and one-half per cent. on the capital stock. The company has declared the usual quarterly dividend of one and one-fourth per cent. payable July 15.

The Western Union Telegraph Company is furnishing to members of the New York Stock Exchange very handsomely designed, synchronized self-winding clocks, with bell attachments, which strike at 12 noon and 2:15 P. M., delivery hour, exactly in accord with the standard time from the United States Naval Observatory at Washington. It is said that these clocks never vary, never get out of order, require no regulating; in fact, are exactly what is required in every broker's office, where perfect accuracy of time is so essential. The clocks are not sold, but are rented for a small monthly charge.

The Halifax-Bermuda Submarine Cable.—A telegram from Halifax, N. S., says that the cable steamer "Westmeath" which is to lay the cable between that place and Bermuda has arrived in port. After laying about 10 miles of heavy cable to connect the office at Hamilton with Castle Harbor, soundings were taken from the latter place to the Halifax harbor. The bottom was found to be very smooth and soft. The shore end will be landed at a lumber yard, near the direct United States cable. The "Westmeath" left England May 23. She is fitted with four circular iron tanks, in which the cable is coiled and kept constantly under water. Her machinery for repairing and surveying purposes is of the most improved kind. It is expected that the work of laying the cable will be completed by the end of the month.

The American Rapid Telegraph Company.—Judge Bond, in the United States Circuit Court at Baltimore, Md., signed a decree on the 18th inst. for $4,156,385 in favor of the Boston Safe Deposit and Trust Company and against the American Rapid Telegraph Company of Baltimore. The amount is to bear interest from the date of the decree, and the telegraph company is required to pay in addition all the costs of the suit. This was the final decree of foreclosure and sale under a mortgage for $3,000,000 given by the American Rapid Telegraph Company of Connecticut, and the auxiliary companies formed under the same name in different states, to the Boston Safe Deposit and Trust Company as trustee, to secure the payment of certain bonds issued for the purpose of improving and developing the telegraph system belonging to the companies. Under this decree the entire property of the American Rapid Telegraph Company will be sold in New York at such time as Nathan B. Bates of Connecticut, the special master, shall designate.

The Quotation Service in Boston, which has been furnished by the Financial Telegram Company will, hereafter, be furnished by the United Telegram Company. The directors of the new company are: William H. Baker, vice-president of the Postal Telegraph Company; John O. Stevens, secretary of said company; Edward C. Platt, treasurer of the Commercial Cable Company; Gen. Oscar H. La Grange, former director of the mint of San Francisco, and William B. McNeice, all doing business in New York; Capt. Nathan P. Carver and Eugene P. Carver, of Boston. The officers are: Gen. LaGrange, president; Capt. Carver, vice-president, and Eugene P. Carver, secretary and treasurer. The United Telegram Company expects to report stock and grain quotations and financial and commercial news in different cities in New England, and the company will act under contracts with the Postal Telegraph Company and John W. Mackay and other persons and corporations from whom it may be able to obtain news of that nature.

THE TELEPHONE.

The American Bell Telephone Company has 2,830 stock holders.

Orangeville, Ont.—The office building of the Bell Telephone Company was considerably damaged by fire recently.

The Southern Bell Telephone Company has purchased property at Atlanta, Ga., upon which to erect a building to contain its central office.

C. F. Annett, General Manager of the Rocky Mountain Bell Telephone Company, was in Park City, Utah, last week looking after the interest of the company.

The Metropolitan Telephone and Telegraph Company of New York City has received a permit to erect a seven story building on the northeast corner of Broad and Pearl streets.

The Bell Telephone Company, according to rumors current in Boston financial circles, is about to take action for the retirement of its seven per cent. bonds Aug. 1 of this year.

Long Distance Telephone in Canada.—Lines of telephone through which conversation can be conducted a distance of 230 miles will soon be completed in Canada, uniting provincial towns with Capitals.

The Superior Civil Court for Essex County has rendered a decision against the New England Telephone and Telegraph Company, in an action brought by one Tyler, to recover the value of a horse, in the sum of $200.

The Bell Telephone Company has brought suit in the United States Circuit Court at Philadelphia, Pa., to have Steinmetz & Becker enjoined from using a telephone alleged to be an infringement on the Bell patents.

Bi-metallic telegraph and telephone wires are being constructed at Joinville-le-Pont which give, according to the investigations of the Ministry of Posts and Telegraphs, very flattering results as to conductivity and resistance when compared with ordinary copper wire. If the experiments thus far made are verified in practice, the result will be a considerable economy in the cost of long distance telephone lines and also of telegraph wiring. The new wire seems to be an important discovery.

The Tropical American Telephone Company, of 95 Milk street, Boston, Mass., has arranged with The E. S. Greeley & Co., J. H. Bunnell & Co., and B. Blum & Co., to sell their American Bell telephone sets and apparatus for export to Central and South America and the West Indies, to which countries the Tropical company alone holds the right to export from the United States. James H. Howard, the general manager of the Tropical company, has also made arrangements to take the agency of a Hanover (Germany) manufacturer's goods.

The Mexican Telephone Company's contract with the city government of the City of Mexico expired on the 16th inst. It will also be necessary to renew, at an early date, the contract with the federal government, for the use of the highways and government thoroughfares, and the free importation of materials. Notwithstanding the statement that has appeared in the Boston papers that there is no opposition to a renewal of these concessions, a special dispatch from the City of Mexico says that two European companies are competing for them. Although nothing is yet definitely settled, it is likely that the contracts with the old company will be renewed.

The Erie Telegraph and Telephone Company at its annual meeting, held in this city, elected the following board of directors: Abner S. Adams, Charles E. Adams, Charles J. Glidden, Francis Jewett, J. W. C. Pickering, Levi Sprague and Asa C. Russell, Lowell; Wesley A. Gove, East Boston; W. J. McKinnie, Cleveland, O.; James W. Weston, Manchester, N. H.; Harvey A. Whiting, Wilton, N. H. The directors organized by the choice of Levi Sprague, president; Charles J. Glidden, secretary and treasurer; J. P. McKinstry, general manager. At the annual meeting of the Southwestern Telegraph and Telephone Company the above officers were elected, with the exception of Mr. McKinstry, and in addition John E. Hudson and Gen. Thomas Sherwin as directors, they representing the interests of the American Bell Telephone Company.

The Erie Telephone Company now operates through three sub-companies, one of the sub-companies being divided into three divisions, making in all five divisions, as follows: Arkansas division, the State of Arkansas; North Texas division, all that part of Texas north of a line drawn through the State from east to west at Waco; South Texas division, all of the State south of this line; Northwestern division, the States of Minnesota, North and South Dakota and six counties in Wisconsin bordering on the Mississippi River; Cleveland division, the city of Cleveland and all of Cuyahoga County in Ohio. The net increase of subscribers for the month of May was as follows: Arkansas division, 12; North Texas division, 23; South Texas division, 31; Cleveland division, 49; Northwestern division, 70; total, 185. The total increase for the first two fiscal months of this year was 292.

The New England Telephone and Telegraph Company, has quite outgrown its quarters at Pearl street, Boston, and welcomes the near completion of the American Bell Telephone Company's new building at the corner of Milk and Oliver streets. The operating room of the New England Company will be on the ninth floor of the new building, and will be fitted with new multiple switch boards of the latest pattern, which are now being manufactured by the Western Electric Company of Chicago, and will accommodate 5,000 subscribers. This new multiple board will cost it is said nearly $100,000. The general offices of the company are to be on the eighth floor, giving a grand view of the harbor and the surrounding shores. The wires will all enter the building by underground cable, and will extend to the operating room through a large shaft or well hole. The work of removal will be arduous, but without interruption to the service.

THE ELECTRIC LIGHT.

Morgantown, N. C., will adopt electric lighting.

Greenwich, Conn.—The electric light plant is now in operation.

Holyoke, Mass.—The electric light company is to have a new building.

Canton, Mass.—The electric light station has completed its equipment.

Louisville, Ky.—An electric light plant will be erected by the Louisville Gas Company.

Selma, Ala.—An isolated electric light plant will be added to the Matthews cotton mill.

Tecumseh, Mich.—An electric light company has been incorporated with a capital of $30,000.

Medina, N. Y.—The electric light company is building a fire proof station of modern design.

Fairmount, N. J.—Electric lights are held out as one of the summer attractions of this place.

Salisbury, Tenn., is to have an electric light plant to furnish lights for public and private use.

Beverly, Mass.—A new station is to be built by the Beverly Electric Light and Power Company.

Lebanon, N. H.—Before the summer is over there will be over 100 electric lights in operation.

Spartanburg, S. C.—An isolated electric light plant is now in operation in the Spartan Cotton Mills.

Richmond, Ky.—The electric light, gas and water works have been purchased by A. E. Boardman, of Macon, Ga., and Messrs. Woodbury and Moulton, of Portland, Me.

Macon, Ga.—The city authorities have voted to issue bonds for $25,000 to establish a municipal lighting plant.

Greenville, S. C.—A company of outside capitalists has been organized to establish an electric light plant.

Carrollton, Ga.—The electric light plant, consisting of 200 incandescent lights, is about ready to begin operations.

Johnston, R. I.—Several changes are being made in the locations of the electric lights and new ones are to be added.

Cartersville, Ga.—Parties from Rome, Ga., are endeavoring to organize a company to build and operate an electric light plant.

Keokuk, Ia.—The authorities are advertising for bids for the city lighting, the contract to run for five years, gas or electricity to be used.

Little Rock, Ark.—The Edison Electric Light Company's plant has been purchased by G. T. Van Etten, who will operate it in future.

Sherman, Tex.—The electric light plant belonging to the city is to have some additional arc lights, with possibly an extra dynamo.

Hiawatha, Kan., is to have an electric light plant of 500 lights. The Westinghouse system of alternate current incandescent lighting will be operated in the plant.

The Hamilton Electric Light Company, of Hamilton, O., has contracted for a 500-light Westinghouse alternate current incandescent dynamo to add to its plant.

The new town of Kimball, in Tennessee, will establish a system of electric lights, and the Kimball Town Company is now in the market for the necessary equipments.

The Electric Light Company in Newport, R. I., has closed a contract with the Westinghouse Electric Company for one of its 500-light alternating current dynamos.

Electric Lights and Water Works.—At a recent election in Gainesville, Ga., the question of issuing $40,000 of bonds for the

establishment of electric lights and water works was satisfactorily settled.

Electric headlights of 25 c. p., supplied with current from a storage battery carried in the baggage car, are to be tried upon the Connecticut River Railroad, in New England.

Vinton, Iowa, is one of the latest central station plants to be furnished with the Westinghouse alternate current apparatus. This plant will start with a capacity of 500 16-c. p. lights.

Saginaw, Mich.—The Westinghouse Electric Company has received the contract for the installation of an alternating current dynamo of 750 lights for the electric light company recently organized.

Detroit, Mich.—C. A. Warren has on exhibition at his office an interesting photograph of about a mile and a half of track on the Michigan Central Railroad taken at night by the new electric headlight in use on that road. Every large object can be plainly seen.

Yazoo City, Miss.—The Thomson-Houston Electric Company, of Boston, has, through its agent, made a proposition to the city for the establishment of an electric light plant, with the construction of water works. The cost of the two plants will be about $45,000.

Tacoma, Wash.—The electric light has evidently found favor in Washington state. A company which started in the town of Tacoma less than a year ago, with a 750-light plant has already been obliged to make arrangements for an increase of its capacity. A contract was awarded the Westinghouse Electric Company for alternating current apparatus of 150 lights capacity.

North Smithfield, R. I.—When the bill of the Woonsocket Electric Machine and Power Company for furnishing electric lights was presented to the town council last week it was stated that the lights were not kept up to the guaranteed 2,000 c. p.; but attention was called to the fact that the phraseology of the contract was "so-called 2,000 c. p." The bill was allowed.

Woodsville, N. H.—A new electric light plant will soon be erected at this place. The building will be a brick structure, with granite foundations, and will be 38 × 40 ft., one story high, with flat roof. Power will be derived from a 100 h. p. engine, with 125 h. p. boiler. It is intended that during the season of steady water the dynamo shall be driven by the large turbine, the engine to be used as a relay.

Palmer, Mass.—A telegram from this place says that at a meeting of Ware business men the Ware Power and Improvement Company was organized, with a capital stock of $10,000. Over $6,000 is already taken. W. S. Hyde is treasurer; R. H. Loomis, secretary; E. H. Gilbert, Dr. W. W. Miner, and Andrew Bryson, directors. The object of the company is to furnish electric light and power for the town.

Chicago, Ill.—The People's Electric Light Company is demanding that the city carry out the contract entered into between that company and the old Town of Lake for 200 arc electric lights at $12.50 a lamp per month. The city, it is said, will probably refuse to do so on the ground that one corporation cannot bind a succeeding corporation to a contract. The contract is dated July 13, 1889, and was to run four years.

Columbus, O.—A test was made last week of a new electric headlight on a locomotive on the Columbus, Hocking Valley and Toledo Railroad. Its operation is reported as a complete success. The inspecting party included General Superintendent Rockwell, Master Mechanic Miller, and other officials of the above road Objects three-fourths of a mile away could be distinctly seen along the track in front of the light.

The Westinghouse Electric Company has received cable advices from England saying that it has been awarded the contract for furnishing a complete outfit of its alternate current apparatus for the establishment of a plant in Barnsley, Yorkshire. At a recent meeting of the town council, that body decided to discontinue the use of gas as an illuminant of the town and to substitute the modern method of lighting. The plant is to have a capacity of 6,000 16 c. p. incandescent lamps and 100 arc lights of the new Westinghouse alternating current arc lighting system. The contract is said to have been obtained in the face of the keenest competition.

The Electric Light at Cannes.—The authorities of the city of Cannes have received a request for a concession, to run for 20 years, for the placing of electric cables and wires under or over the streets of the city, for the furnishing of electric light to individual consumers. The syndicate asking the concession is backed in its request by the hotel owners of the city, who have already subscribed for 1,200 lights. The lamps are to burn from sunset to midnight during 7½ months of the year and the price is to be 51½ francs per lamp. This arrangement will be all very well for the hotel proprietors, who would use the lamps for the entire time contracted for, but it would not suit the shopkeepers, most of whom wish to get their light by the hour; and with this amendment it is probable that five or six thousand lamps will be put in service. There is much discussion of the matter, however, and it is not improbable that other bids will be offered the municipality.

APPLICATIONS OF POWER.

Knightstown, Ind., is to have an electric railway.

Bangor, Me.—The extension of the electric railway is progressing rapidly.

West Superior, Minn.—The electric street cars are now running successfully.

Salt Lake, Utah, will invest at least a million dollars in the installation of electric railways.

Lowell, Mass.—A new dynamo has been added to the power equipment of the Lowell and Dracut electric railway.

Binghamton, N. Y.—A 200 h. p. engine has been added to the power house equipment of the electric street car line.

Muskegon, Mich.—An electric railway is now being constructed between Muskegon and the Lake Michigan beach.

Dallas, Tex.—The Rapid Transit Company, recently incorporated, will construct a Sprague electric railway to be five miles in length.

Buffalo, N. Y.—A company has been formed to build an electro railway between Buffalo and Niagara Falls, N. Y., a distance of over 20 miles.

The Roanoke (Va.) Power Company has been incorporated with a capital stock of $250,000. The president of the company is R. L. Gardner.

To Manufacture Electric Motors.—A plant will be erected at Richmond, Va., by R. W. Traylor, which will manufacture a newly patented electric motor.

East Reading, Pa.—The directors of the East Reading Electric Railway Company contemplate extending their line to Boyertown, 18 miles east of Reading.

Johnston, R. I.—The Union Railroad Company has asked permission to erect poles for supporting electric wires in all highways of the town in which it has received permission to run cars.

Providence, R. I.—One of the Julien storage battery cars of the Union Railroad has been taken out several times during the past fortnight, and has been run experimentally between Trinity Square and Roger Williams Park.

Lawrence, Mass.—The syndicate that purchased the Merrimac Valley Street Railroad met in Lawrence on Thursday of last week. No new company will be formed. The company will simply be extended with an increase in its capital stock.

Baltimore, Md.—A company has recently been organized to build an electrical railway to Curtis' Bay, five miles distant. The company has a capital stock of $50,000, and the president is Wm. S. Rayner, with W. C. Pennington as secretary and treasurer.

Tariffville, Conn.—Work is now well under way on the new dam to be built for the Farmington Power Company on the Farmington River below Tariffville. This company is going to furnish electric power for lighting Hartford and for other purposes.

Belfast, Me., now boasts of an electric grist mill on one of its wharves, the power being delivered by a 30 h. p. Thomson-Houston motor. The mill is equipped with a set of stones and one roller mill, and can turn out from 300 to 400 bushels of meal per day.

Beverly, Mass.—During the month of May the expense for motive power on the Beverly and Danvers storage battery street railway was estimated at six and a half cents per car mile. The system is that of the Union Electric Car Company, and is founded upon patents granted to W. L. Stevens.

Haverhill, Mass.—Some New York parties, together with C. W. Morse, B. B. Jones, and other gentlemen of Haverhill, have formed a syndicate for the purpose of building an electric street railway from Haverhill to Lawrence, Mass. Work will be begun, it is said, as soon as the city grants a permit to lay tracks in the streets.

Aurora, Ill.—The entire stock of the Aurora Street Railway Company has been purchased by a New York syndicate. The new company will at once construct and equip an overhead electric railway system, and expects to have a line running to the driving park in time for the July races. Aurora is jubilant over the certainty of rapid transit.

Detroit, Mich.—By July 1 it is expected that the new Highland Park electric railway will be put in operation. The poles are on the ground and will be placed in position at once. The trolley wire will be carried upon brackets attached to the poles. The telephone wires will be strung upon the same poles. A new car house, 40 x 100 feet, will be built at the northern terminus of the road.

South Chicago, Ill.—Work was started last week on the Calumet electric railroad. There will be two gangs of men put at work, so the construction will go on night and day without any halt. The part of the road that will be first completed will be from South Chicago to Dauphin Park along Ninety-third street. The franchise calls for that part of the road to be running by July 1.

Newton, Mass.—The Newton aldermen held a protracted session last Thursday evening. The chief business was the hearings granted to the Central Street Railway Company and the Garden City Electric Street Railway Company on their petitions for locations for tracks from a point near the Boston and Albany railroad crossing in Newtonville, thence through Walnut street to Newton Centre.

Beverly, Mass.—The directors of the Beverly and Danvers Street Railroad Company have voted to increase the capital stock to $25,000 and petition the selectmen of Danvers for leave to extend their tracks through Willow street to Putnamville and for leave to run over the Naumkeag tracks to Danvers Plains. This road is now operated by electric power, and is the only storage battery road in New England.

The Illustrated American, in its issue of June 21, unconsciously gives a first class indorsement to the carrying capacity and consequently earning capacity of electric street railways, in its excellent reproductions of photographic views of scenes in Cleveland, O., on Decoration Day. On page 13 a motor car, with a trailer attached, is shown and every foot of available space on both cars, except the roofs, is occupied by adult passengers on their way to the cemetery.

Detroit, Mich.—A new storage battery street car has just been completed at the Detroit Electrical Works, and last week some trial trips were made with it on the Gratiot & Woodward avenue line. The car is fitted with 96 cells, each weighing 42 pounds, of the type known as the Pumpelly battery. The order for the car was received only four weeks ago from the Middlesborough (Ky.) Street Railway Company, and as the car is now ready for operation, it will be shipped at once.

The Bangor Street Railway Company, operating its road by electric power, reports that its earnings at present are considerably in advance of what they were last year. It carried 13,341 passengers the first week of June of this year, and earned $705.36, against 8,521 passengers and earnings of $451.40 for the corresponding period in 1889, an increase of 4,820 passengers and $253.96 the present year. This road is three miles in length, is equipped with five electric cars and has been in operation since May 21, 1889.

Chicago, Ill.—The Cicero and Proviso Street Railway Company has applied for a permit to lay tracks for an electric line in that portion of the city formerly a portion of Cicero. The franchise of the company is dated April 18, 1889. A power-house has been erected and the company asks for a permit to go to work on the streets named in the franchise, viz: Madison, from Fortieth to Harlem avenue; Lake and Forty-eighth streets to Harlem avenue, Harlem avenue and Forty-eighth street, from Lake to Madison.

PERSONALS.

Mr. Allen R. Foote entered upon the duties of secretary and treasurer of the National Electric Light Association, Tuesday, June 17.

Henry Villard, president of the Edison General Electric Company, and Mrs. Villard, are announced to sail for Europe, July 2, to be absent a year or more.

Mr. Howard Wheeler, of the railway department of the Thomson-Houston Electric Company, has been transferred to the New York office of that company.

Mr. George E. Emmons, head accountant of the Thomson-Houston Electric Company's works at Lynn, Mass., was in New York last week on a business trip.

Mr. Phillip Saltonstall, now engaged in the electrical business with the Thomson-Houston Motor Company was married at Milton, Mass., Wednesday, June 18.

Mr. M. J. Francisco, of Rutland, Vt., has been elected chairman of the committee appointed to revise the constitution and by-laws of the National Electric Light Association.

Mr. Calvin Humphrey, one of the authors of the paper on transformers read last week before the American Institute of Electrical Engineers, was married recently at Coolsville, O.

Mr. James Pollock McQuaide, of the National Conduit Company, was married at Sea Girt, N. J., Thursday evening, June 26, to Miss Sara S. Parke, daughter of Dr. and Mrs. George T. Parke. THE ELECTRICAL WORLD extends its congratulations to Mr. McQuaide and his bride.

Mr. J. J. Wood, of the Ft. Wayne Electric Company, has bought a $50,000 house in Ft. Wayne, Ind., and will move his family there. The factory of the Ft. Wayne Electric Company in Brooklyn is to be moved to Ft. Wayne. Mr. Wood's hobby outside of his inventions is diamonds. He is said to have a fine private collection of the sparkling gems.

Mr. H. A. Cleverly, of the Cleverly Electrical Works, Philadelphia, Pa., is a man who has excellent taste in the selection of æsthetic stationery, both for his office and for private use. He has recently given his friends the benefit of his good taste in this line by the preparation of a very handsomely designed blotter, which upon its face, bears evidence of his good judgment. He intends that all his friends and patrons shall be supplied with these choice blotting pads. The letter-head upon his office stationery is a work of art, and his return envelope is a unique and striking production none of which will ever find its way into the Dead Letter Office.

MISCELLANEOUS NOTES.

Portland, Me.—The Orient Electric Company has been incorporated with a capital of $100,000.

A system of electric homeopathy is said to be successful in curing leprosy. It is used in India with success.

Mica.—It is said that there are large deposits of mica in Jefferson, Clear Creek and Fremont counties, Colorado.

The Edison General Electric Company has declared it third quarterly dividend of two per cent., payable July 3.

Natick, Mass., is to have an addition to its manufacturing industries. The Waltham Electric Clock Company will open a factory at that place.

The Cobb Vulcanite Wire Company, of Wilmington Del., was last week awarded the contract for 30 miles of one-inch electric cable at $607.20 per mile.

Detroit, Mich.—The Detroit Electrical Workers' Association has appointed a committee to visit the men recently injured in accidents and learn if they need any assistance.

Lynn, Mass.—The baseball team of the Thomson-Houston Electric Company's factory succeeded in winning a game from the Waltham (Mass.) Club last Tuesday by a score of 12 to 7.

Electrical Execution.—Harris A. Smiler, convicted of murder in the first degree, was sentenced on the 18th inst. to die by electricity at Sing Sing during the week beginning August 4.

Brown University, at Providence, R. I., will add a new instructor next year to its physical department. He will be employed in connection with the new physical laboratory.

Stevens Institute of Technology.—The graduating class this year numbers forty, the largest ever graduated from the Institute. Each one receives the degree of Mechanical Engineer, and it is said that a good position has already been secured by each member of the class.

Providence, R. I.—According to the Providence *Journal* there is not the least doubt that the privilege of controlling the electric subway in that city for 25 years, which was given away by the city council, could have been sold for the benefit of the city for $100,000, or more.

The National Electric Light Association.—At a meeting of the executive committee, held Monday, June 16, it was decided to hold the twelfth convention of the National Electric Light Association at Cape May, N. J., Tuesday, Aug. 19. Full details of the arrangements made for the convention will be published at a later date.

National Electric Development Company has been organized with these directors: George A. Davis, John C. Turner Henry C. Miller, Charles D. Cushing, and C. J. Tallon, of San Francisco. Capital stock, $500,000, divided into 10,000 shares; $2,500 subscribed. The company will engage in a general electric, engineering and contracting business. A certificate has been filed with the clerk of Contra Costa County, Cal.

The United Electric Equipment Company, of Philadelphia, Pa., calls attention to the fact that its list of incorporators, as given in the last issue of THE ELECTRICAL WORLD, contained one or two slight errors. The list of incorporators should read as follows: William J. Merrill and Henry N. Almy, of Philadelphia, Pa.; C. R. Eberle, of Wilkes-Barre, Pa.; B. Masden Vaughn, Wilmington, Del.; and Frank C. Mateer, of Camden, N. J.

The streets of New York city were opened 19,371 times during 1889 by the gas, electric light, subway and steam heating companies. Openings were made by the different companies as follows: Consolidated Gas Company, 10,132; Standard Gas Light Company, 2,825; Equitable Gas Light Company, 2,596; New York Mutual Gas Light Company, 633; Edison Electric Illuminating Company, 1,827; Consolidated Telegraph and Electric Subway Company, 851; New York Steam Company, 457. Total, 19,371.

A New Catalogue of the Fishkill Landing Machine Company, of Fishkill-on-the-Hudson, N. Y., has just been issued. It contains about 50 pages of finely executed illustrations and well written descriptive matter of the Fishkill-Corliss engines, horizontal and vertical, single and compound, together with a description of some recent improvements made in the valve-gear and dash pots. The pamphlet also gives a long list of references to and testimonials from the company's customers, affording a good index to the wide use of this style of engine.

Mr. F. H. Tidnam, General Manager of the Elizabeth, N. J., Electric Light Company, writes us, in regard to our editorial appeal for a real lightning arrester, that the Swinging Ball arresters used on the long incandescent circuits in Elizabeth effectually prevented any damage from the recent severe storms. Mr. Tidnam believes that a line should have arresters placed along it at frequent intervals, and for this reason he devised (aided by Mr. J. E. Browne), an arrester whose cost is so small that its use in this manner is not too expensive. This plan has been eminently successful in Elizabeth.

The Standard Underground Cable Company has had a gratifying increase in business lately and, having outgrown its present manufacturing quarters, has decided to emigrate to Brinton station, 13 miles from the city and two miles from the new Westinghouse Air Brake town, Wilmerding. The ground on which the plant is to be erected is owned by the East Pittsburgh Improvement Company, composed principally of Westinghouse people. Streets and avenues have been laid out surrounding the site for the works, and these embryotic thoroughfares are appropriately designated "Ampère street," "Electric avenue," "Volt

Way," and so on. The town will occupy about 100 acres, the factory of the cable company six acres.

Ithaca, N. Y.—The graduation exercises of Cornell University took place on the 19th inst. The degree of Mechanical Engineer in Electrical Engineering was conferred upon 28 young men, many of whom have already secured promising positions with the large electric companies. The programme of the commencement exercises included one subject of an electrical nature, that of "Electricity and Public Opinion," which was well treated by William Nelson Smith in a brief but thoughtful speech. Those who were awarded degrees were: George Hall Ashley, Henry Primm Broughton, Percy Alfred Clisdell, Hayward Cochrane, Joseph Walker Cowles, Samuel B. Fortenbaugh, Frank Fairfield Goodwin, John Eckert Greenawalt, Louis Watres Healy, Arthur Hobert Herschel, Sherwood Johnson Larned, Max Levy, Julius Smith Loomis, Ph. Bell Woodworth, B. S., William Henry Powell, Joseph Cowan Ramage, Eugene Aertsin Rumsey, Harland Aaron Sawyer, Eugene Charles Sickles, William Nelson Smith, Olin Ames Stranahan, Milton E. Thompson, Howard Ford Thurber, William Boardman Tobey, George Hicks Walbridge, Edward H. Waldo, A. B., John Ackroyd West, Jr., Ed. Adam Wilhelm. Those awarded the degree of Master of Mechanical Engineer for special study in electrical engineering were Arthur B. Levy, B. S., Louis B. Marks, B. S., and Calvin Humphrey, A. B.

BUSINESS NOTICES.

Steam Pipe and Boiler Coverings.—The H. W. John's Manufacturing Company, 87 Maiden Lane, N. Y., make a specialty of applying their coverings in any part of the United States. Send for estimates.

The Page Belting Company, of Concord, N. H., manufacturers of leather belting, both staple grades and specialties, has recently received an order from the Dansville (N. Y.) Electric Light Company for some of the "Acme" link belt.

The Battery Cut-Out sold by the Electric Supply Company, of Syracuse, N. Y., 105 South Warren street, is cheap. Thoroughly tested, it is giving complete satisfaction. It automatically prevents the short-circuiting and damaging of gas lighting and other batteries. Send for circular.

The Whitmore Manufacturing Company of Pittsburgh, has awakened to the fact that the making of electric light poles is a remunerative business, and, accordingly, has equipped a factory and will shortly be ready to turn out poles. Already many orders have been booked, and the outlook is excellent. The pole which the Whitmore Company has devised is said to be an excellent one. Iron forms the basis of its construction.

American Electrical Directory.—The Star Iron Tower Company are now compiling the American Electrical Directory for 1890. They report that the number of central stations and electrical railways throughout the country has increased to such an extent as to nearly double the list found in the Directory of 1889. No pains are being spared to secure data from every lighting station and railway plant in America. Some lighting companies are slow in returning reports which it is desirable should be done at once.

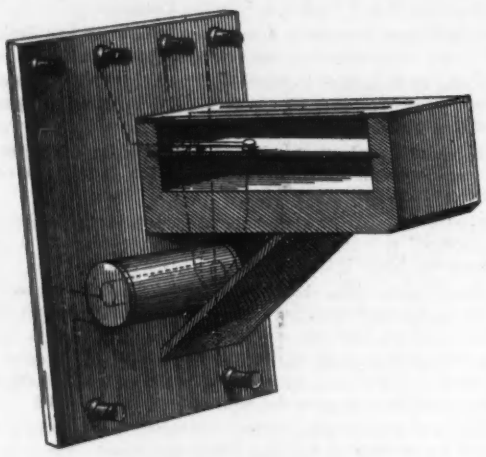
The American Electrical Directory is the only publication which attempts to thoroughly represent the subject of which it treats. It is now in its fifth year and is recognized as the standard work in its line.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. Patents Issued June 17, 1890.

430,128. Telephone; John H. Irwin, of Morton, Pa. Application filed April 24, 1880. In a telephone transmitter, a diaphragm having both electrodes mounted upon it, one electrode being mounted directly upon such diaphragm and the other electrode being secured to an elastic arm mounted upon the diaphragm.

430,147. Electric Car; Louis Pfingst, of Boston, Mass. Application filed March 24, 1890. In an electric car, an electric motor mounted on the arch bars, combined with a shaft con-



No. 430,128.—Telephone.

nected by worm gears with the car axles and by friction gears with the motor shaft.

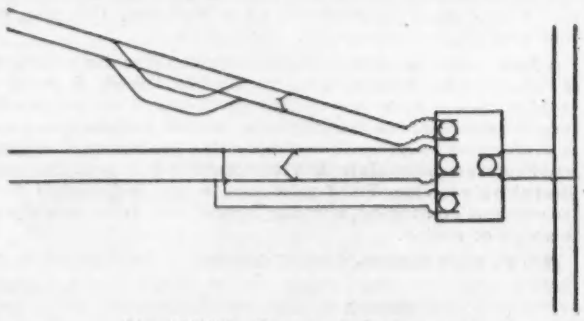
430,156. Manufacture of Incandescent Lamps; William L. Voelker, of Morton, Pa., Assignor to John H. Irwin, Trustee, of same place. Application filed March 9, 1882. The method of manufacture of an incandescent electric lamp, which consists in sealing the electric conductor into a glass support, then seating the glass support into a lower section of the globe, then sealing the lower section to the upper section of the globe.

430,175. Combined Fire Alarm Telegraph and Gas Lighting Device; Charles H. Crockett and Chancellor C. Allen, of Boston, Mass.. Application filed Sept. 3, 1887. The combination, with the motor of a fire alarm system, of a series of gas lighting devices, a series of contact pieces connected therewith, automatic mechanism for successively operating the devices to light the burners and manual circuit breakers for simultaneously extinguishing the burners and resetting the motor.

430,208. Electric Railway; Rudolph M. Hunter, of Philadelphia, Pa., Assignor by Mesne Assignments, to the Thomson-Houston Electric Company, of Boston, Mass. Application filed Dec. 3, 1887. In an electric railway, two or more electric railways or sections of railways in combination with a central section, and separate electric generators for each of the railways or sections of railways located in the central station, whereby the electrical source of all the railways is concentrated at one place.

430,252. Electric Switch; John Amidon Norton, of Bridgeport, Conn., Assignor to John M. Orford, of same place. Application filed March 17, 1890. In an electric switch, the combination, with the terminals and a suitable circuit closer, of an operating spring connected to the circuit closer, a detaining spring engaging the circuit closer with a yielding pressure and means for imparting to the operating spring a power in excess of the resistance of the detaining spring, whereby movement is induced in the circuit closer.

430,260. Arc Lamp; Alferd U. Alcock and Henri Galopin, of Melbourne, Victoria. Application filed April 25, 1889; Patented in New Zealand October 4, 1888; and in Victoria October 9, 1888. In an arc lamp, the combination of an upper carbon supporting bar, a friction cam pressed thereon, an arm to said cam provided with an adjustable weight, the said arm resting upon a stationary support, such as the frame of the lamp, a solenoid provided with a hollow core through which passes the said bar and to which is pivoted the said cam, counterbalancing weights for the said bar



No. 430,208.—Electric Railway.

and the core, and a lower carbon in circuit with the solenoid and the upper carbon.

420,263. Signal for Electric Railways; Edward M. Bently, of Washington, D. C. Application filed August 30, 1884. The invention lies in an electric signaling device operated by the same current which acts to propel the electric locomotives on the line and in a circuit closer operated by a train at a distance to include the signal in circuit and give notice of the approach of the train.

430,275. Magnetic Separator; Thomas A. Edison, of Llewellyn Park, N. J. Application filed Sept. 20, 1888. The invention consists in providing for magnetic separators a gentle current of air, whereby the lighter particles of the falling material are directed into a separate receptacle.

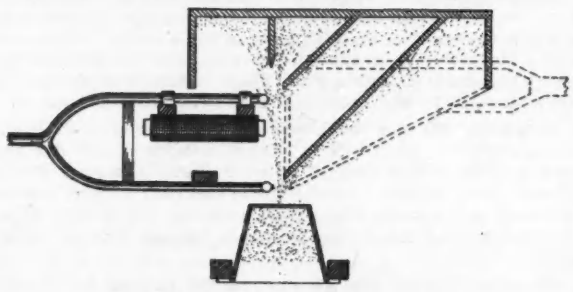
430,279. Voltaic Battery; Thomas A. Edison, of Llewellyn Park, N. J. Application filed July 2, 1889. A voltaic battery having a negative electrode composed of a plate or plates of molded and solidified oxide of copper removably held in a supporting frame which embraces the edges of the oxide plate or plates.

430,280. Magnetic Separator; Thomas A. Edison, of Llewellyn Park, N. J. Application filed July 29, 1889. In a magnetic separator, the combination of a water chamber into which the material to be separated is introduced and magnets inclosed in a drum moving and out of the water chamber, whereby the magnetic material is removed therefrom.

430,296. Insulator; Samuel Oakman, of Melrose, Mass. Application filed Nov. 1, 1889. An electric insulator consisting of a single piece of glass and having a screw pinsocket, an insulating space between the screw pin and its interior, and one or more dovetail projections adapted to receive and hold the wires.

430,297. Underground Electric Cable; William R. Patterson, of Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed May 14, 1889. A cable consisting of a lead pipe and a core of insulated conductors inclosed therein, said core being left dry in alternate sections, the portions of the cable between the dry sections being filled with solid insulating material, and the dry sections containing gas or air under pressure.

430,320. Method of Synchronizing Alternate Current Machines; Edwin Wilbur Rice, Jr., of Lynn, Mass. Application filed Feb. 4, 1888. Methods of connecting in synchronizing two alternating current machines, consisting in interposing a counter electromotive force or reaction in the circuit between



No. 430,275.—Magnetic Separator.

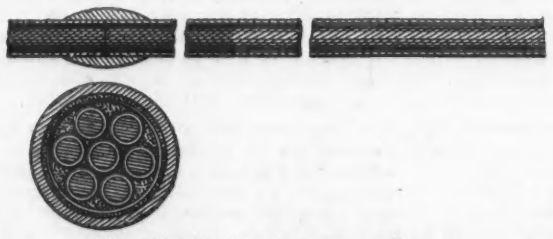
them depending upon the difference in phases of the currents, so as to retard or accelerate one or the other of the machines until the phases of the electrical impulses coalesce or correspond.

430,326. Electro-Magnetic Cut-Out for Electric Lamps; Elihu Thomson and Edwin Wilbur Rice, Jr., of Lynn, Mass. Application filed Sept. 6, 1886. The invention consists in constructing the lamps with a third wire, or a wire in addition to the wires holding the filament, this third wire operating a cut-off coil for closing a shunting contact around the lamp.

430,327. Regulator for Dynamo Electric Machines; Elihu Thomson, of Lynn, Mass. Application filed March 8, 1888. The combination in a dynamo electric machine, of a demagnetizing coil or set of coils wound over the armature, and means responsive to current changes in the circuit supplied by the machine for varying the current in or the number of turns of said coil or sets of coils.

430,328. Alternating Current Motor; Elihu Thomson, of Lynn, Mass. Application filed Jan. 19. 1889. The invention consists in commencing the motor with a different circuit arrangement for its armature from that which it will have under its condition of steady normal working or running, such primary condition being one adapted to give a torque, that being continued for a sufficient time will bring the motor up to the speed where it will be run with the armature on continually closed circuit.

430,329. Electric Railway; Merle J. Wightman, of Hartford, Conn. Application filed April 1, 1885. The combination, in an electric railway system, with a section of feed conductor and



No. 430,297.—Underground Cable.

an electro-magnet in a branch between the sections and a line conductor, of a block electro-magnet in a circuit of high resistance connected to an adjoining section.

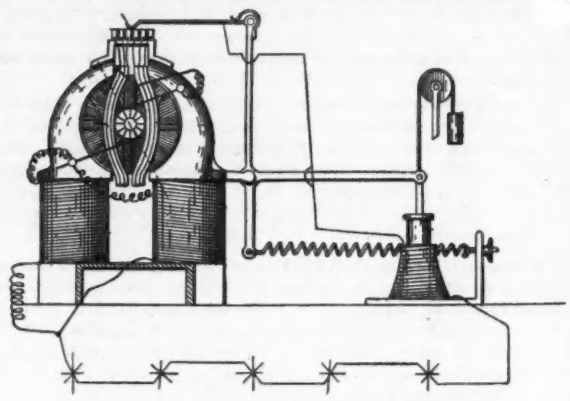
430,357. Electric Arc Lamp; Elihu Thomson, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed March 20, 1886. The combination, in an electric lamp, of mechanism for feeding the carbon step by step, an operating electro-magnet for the mechanism, a circuit controller, one part of which is mounted in a support adapted to move independently of its actuating lever, and a magnet and armature, one of which is carried by the movable portion of the circuit controller while the other is mounted on a fixed support, whereby the parts of the circuit controller are held temporarily in contact.

430,373. Burglar Alarm; Stephen Broichgans, of Milwaukee, Wis. Application filed March 21, 1890. In a burglar alarm, the combination, with a suitable supporting frame, a spring and its casing supported on a shaft in the frame, and a gear wheel on the shaft of a lower shaft carrying a plate, having a cam-edged flange, a gear wheel in mesh with the one above, and an escapement wheel, an escapement connected to a weighted pendulum, an electro-magnet electrically connected to the door or window to be protected, a pivoted lever having a detent for one of the gear wheels and one end and an armature at the other end, and a double toggle lever for operating the alarm pivoted to the frame and having an arm or pin for engagement with the cam edged flange.

430,432. Electric Meter; Joseph Oulton and Joseph Edmondson, of Bradford, County of York, England. Application filed Dec. 12, 1889. Patented in England, Oct. 16, 1888; in Belgium, July 15, 1889, and in France, July 15, 1889. The device consists of a train of clock work having a torsion balance, the vibrations of the balance being accelerated or retarded by the current to be measured the difference between the known normal speed of the clockwork and its speed when influenced by the current indicating the amount of current consumed.

430,437. Incandescent Lamp; Frederic C. Rockwell, of Hartford, Conn. Application filed March 4, 1890. A base for an incandescent lamp consisting of superimposed layers of a thin non-conducting material with a conducting strip embedded between, a portion of the exterior layers being cut away to expose a part of the conductings trip.

430,461. Means for Preventing Boiler Incrustation; William B. Bull, of Quincy, Ill. Application filed November 7, 1889. The invention consists in locating a magnet in proximity to the feed water pipe, whereby the liquid is caused to pass through



No. 430,327.—Regulator for Dynamos.

a magnetic field, and secondly it consists in certain novel details in the arrangement, construction and combination of the parts.

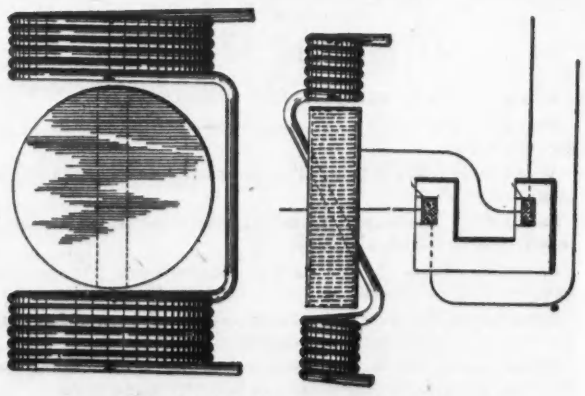
430,462. Electric Incrustation Preventer; William B. Bull, of Quincy, Ill. Application filed March 12, 1890. The invention consists in locating a magnet within and independent of the conduit and further in employing a series of magnets arranged in a bundle or sheaf to act on the liquid at one time, or distributed along the conduit so as to act in succession.

430,485. Incandescent Lamp; Frederick C. Rockwell, of Hartford, Conn. Application filed Feb 28, 1890. A base for an incandescent lamp, consisting of superimposed layers of a thin non-conducting material, the inner layer of the material being corrugated or indented and the exterior smooth.

430,515. Electric Railway; Daniel B. Devoe, of United States Army. Application filed March 27, 1890. The combination with a slotted conduit below the surface of an electric railway, and containing the main conductors, of a trolley block sliding along the slot and having upper and lower lateral portions adapted to respectively bear against the upper and lower surfaces of the top of the conduit adjacent to the slot, said block being provided with depending conductors, together with lateral portions above and below the slot, and motor connections.

430,551. Electric Meter; George H. Wade, of Atlanta, Ga., Assignor of one-half to William B. Palmer, of same place. Application filed April 2, 1890. The invention consists of electro-magnets, whereby the stopping and starting of the current from whatever cause will be converted into a quick motion and applied to actuating a marking device, recording on a suitable moving surface the actions thereof.

430,569. Coin-Controlled Telephone Guard; Samuel M. Dowst and Frank H. Hosmer, of Chicago, Assignors, by direct and mesne assignments, to the said Samuel M. Dowst and Charles O. Dowst, of Evanston, Ill. Application filed July 27, 1889. In combination with a telephone, a gate or door adapted to close the mouth-piece thereof, a catch to engage and lock the door in closed position, a coin chute, a bar controlling the catch and protruding into the coin chute and obstructing the passage of the coin the ethrough, and a second bar also adapted to protrude



No. 430,432.—Electric Meter.

into the coin chute at such distance from the first bar that the selected coin may simultaneously contact both the bars and constituting means for transmitting movement from the second to the first.

430,580. Electric Railway; Rudolph M. Hunter, of Philadelphia, Pa., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed April 4, 1890. The combination with a car body supported upon the axle by means of springs, with a frame supported upon the axles independent of the car body, a suspended conductor and a trolley or current-collecting device carried by the frame independently of the car body and making a traveling connection with the suspended conductor.

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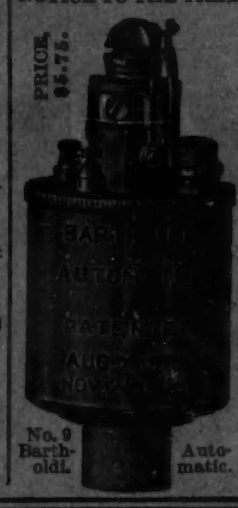

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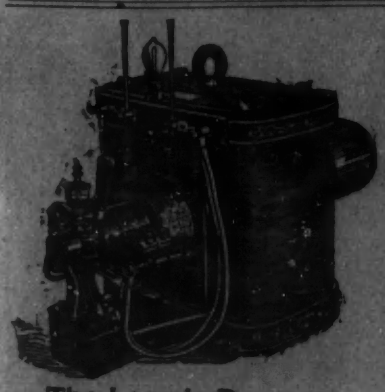

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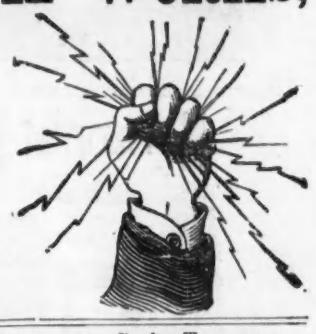

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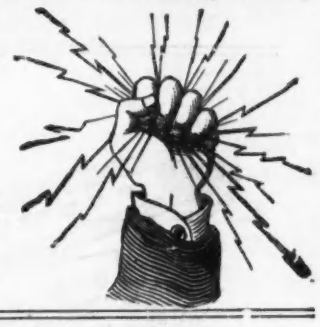

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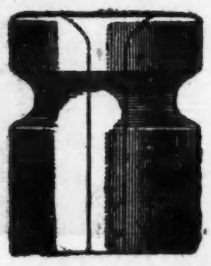

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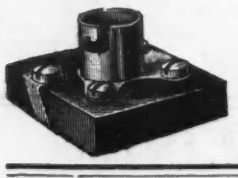

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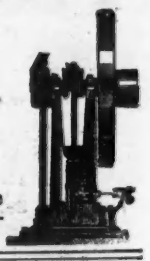

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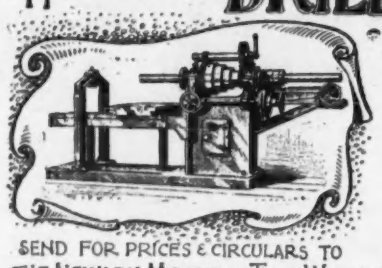

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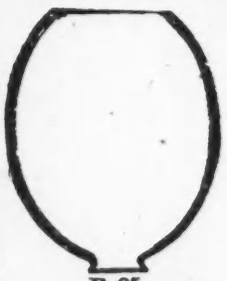
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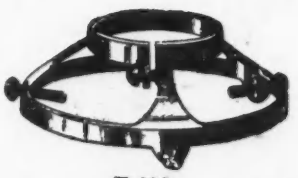
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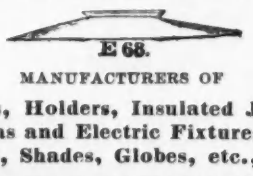
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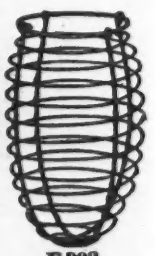
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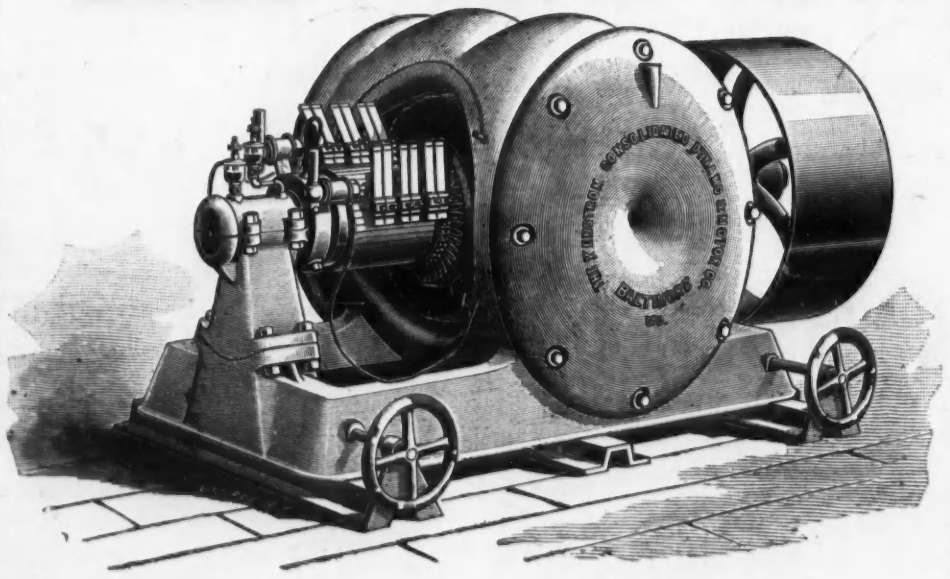

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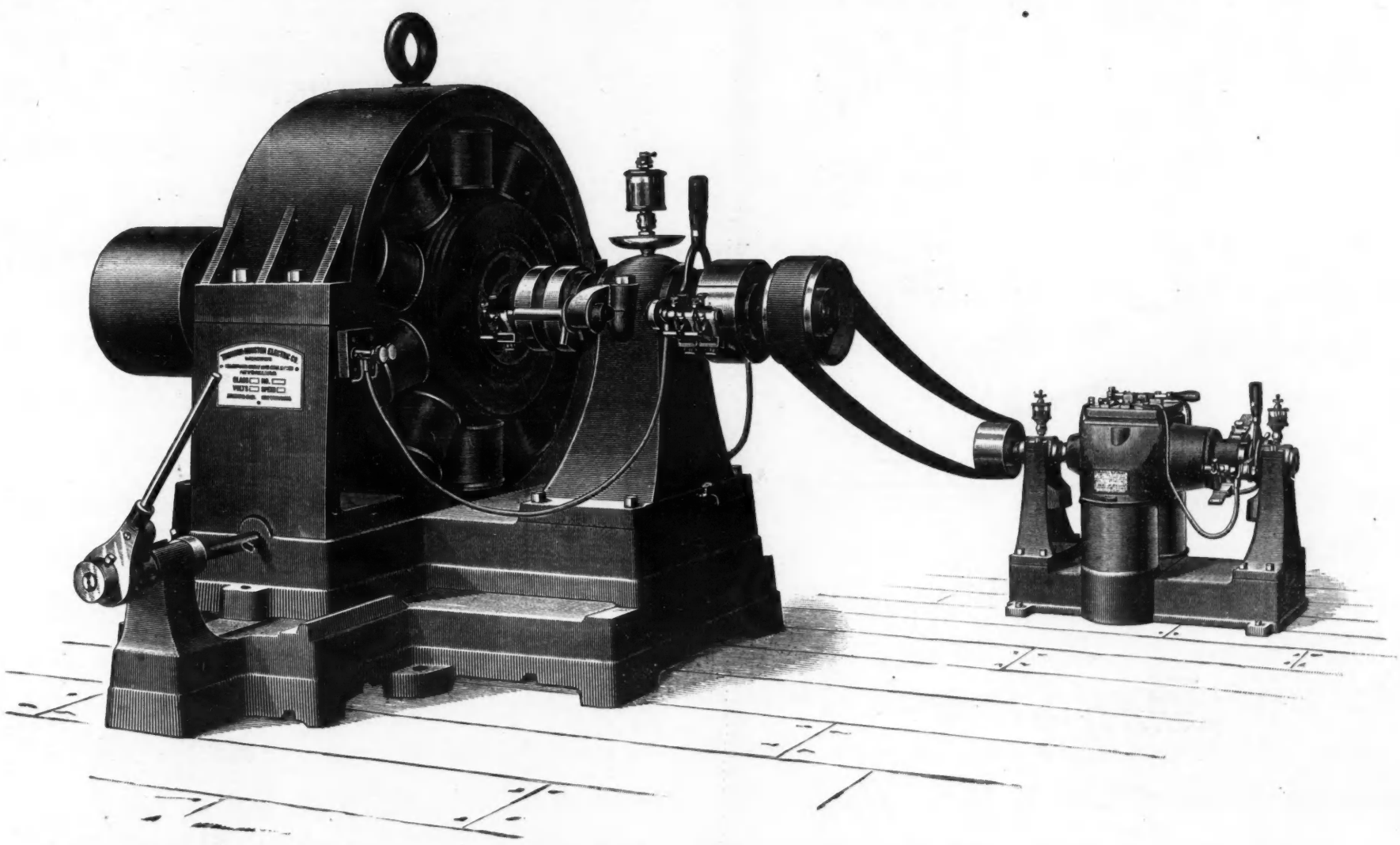

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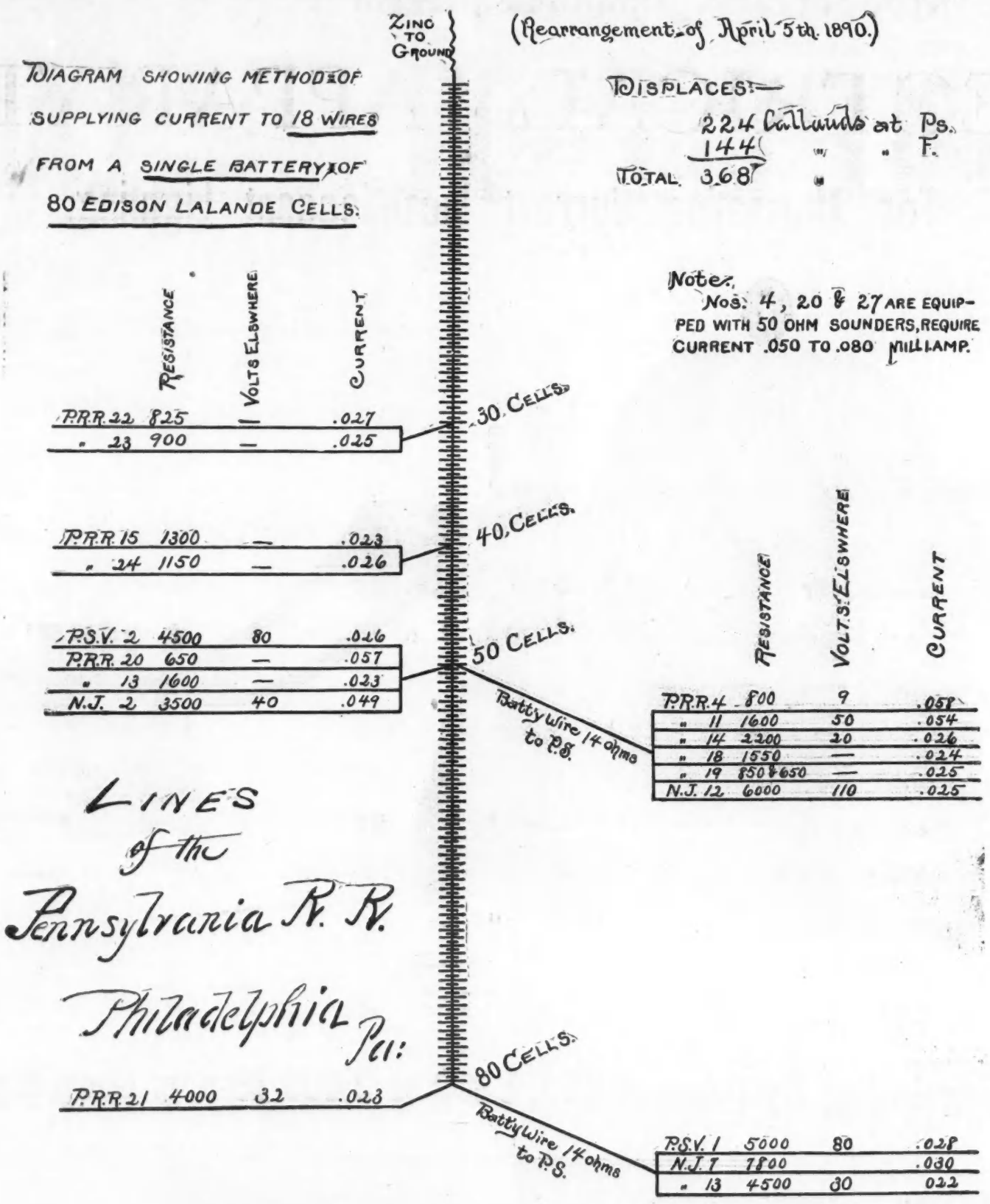
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"6. And it is hereby ordered, adjudged and decreed that the said defendants, the Fort Wayne Electric Light Company, Henry G. Olds, Perry A. Randall and Ranald T. McDonald, together with the officers, successors, or assigns, agents, attorneys and employes of the defendant corporation, be, and they hereby are, perpetually enjoined and restrained from making, using, selling or vending any arc electric lamps in which two or more pairs of carbons are independently adjusted and regulated by one and the same regulating mechanism, and are separated and burned successively, to secure the continuous burning of one pair of carbons prior to the establishment of the arc between the other pair, substantially as described in the specification, and claimed in the First Claim of said Letters Patent, No. 219,208, and also from making, using, selling or vending any electric arc lamps containing the invention or inventions, substantially as described in the specification, and claimed in the Second, Third, Fourth, Fifth or Sixth Claims, or any of said claims, in said Patent No. 219,208, or any imitation, or substantial equivalent thereof, constructed substantially as described in said specification, and as claimed in the said First, Second, Third, Fourth, Fifth or Sixth Claims, and that an Injunction issue forthwith accordingly. And it is further ordered adjudged and decreed that the defendants pay the costs herein to be taxed, and that the complainant have execution therefor."

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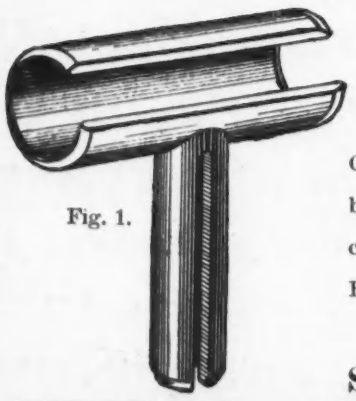
Fig. 1.

Fig. 1 represents Copper Tee used for branching from main cables, as shown in Fig. 2.

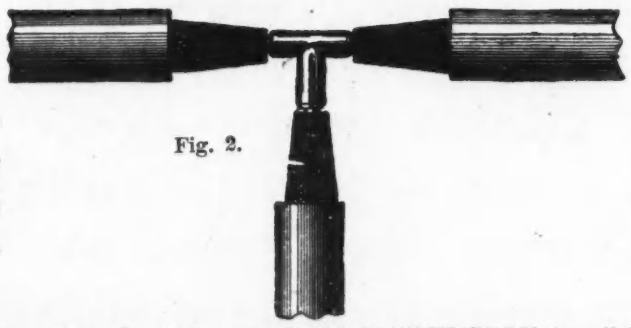
Fig. 2.

Fig. 3 represents a Copper Sleeve used for straight connections for continuation of cables.

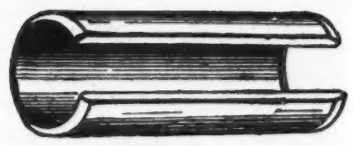
Fig. 3.

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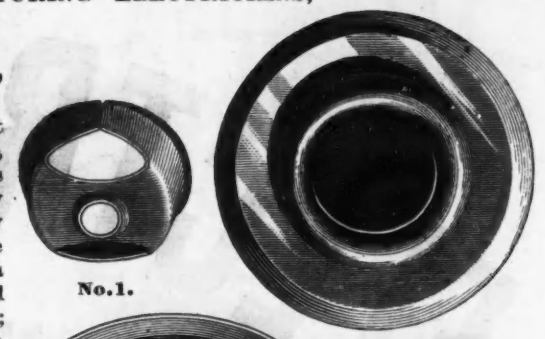

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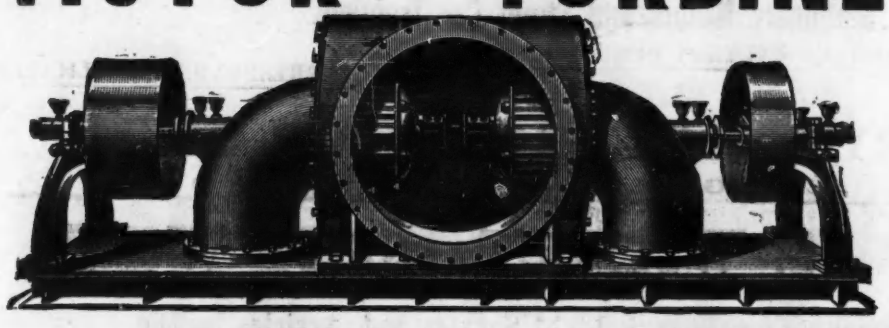

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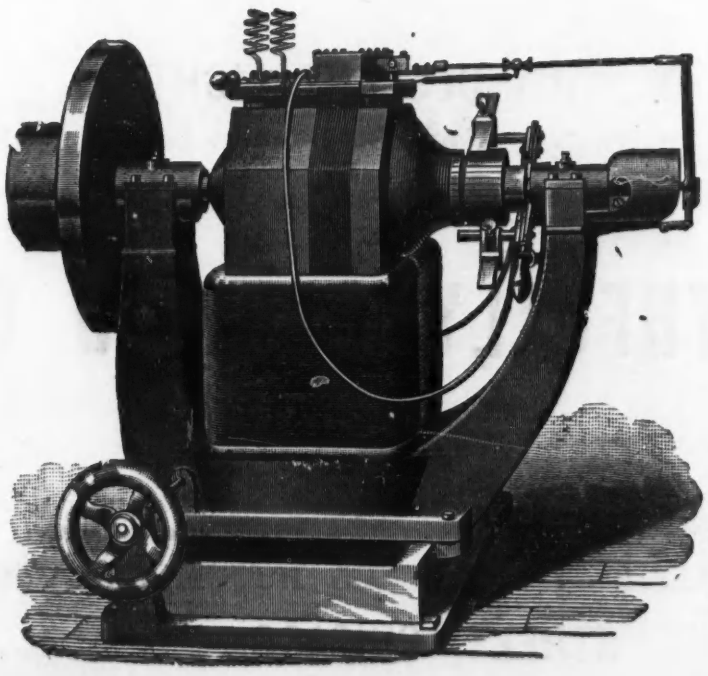

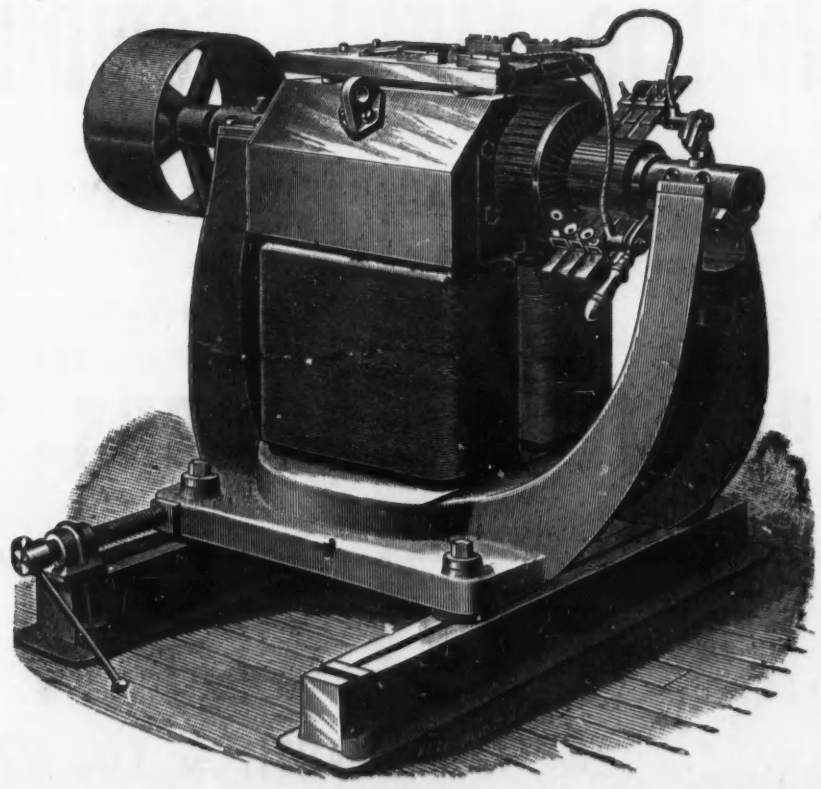

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PUMPELLY - STORAGE - BATTERIES

For Central Lighting, Isolated Plants, Running Stationary Motors and Street Car Traction.

SPECIALLY ADAPTED FOR PHYSICIANS' CAUTERY PURPOSES.

SEND FOR CIRCULARS AND PRICES. CORRESPONDENCE SOLICITED.

PUMPELLY STORAGE BATTERY & ELECTRIC MOTOR CO.,

229 LA SALLE STREET, CHICAGO, ILL.

FINISHED METAL PUSH BUTTONS, WITHOUT INSIDE WORK.

Gas Attachments, Shade Holders, Wire, Connectors and Flanges for Electric Light Service and Articles in the Line of Electrical Work made to Order. Fine Bronze and Brass Castings a Specialty.

IRON CASTINGS of Best Material and Workmanship Promptly Furnished.

Orders Solicited for Castings which Require to be Very Soft and Smooth. Japanning Done to Order.

I. S. SPENCER'S SONS. - GUILFORD, CONN.

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The Baxter Electric Motor Company,

—MANUFACTURERS OF—

ELECTRIC MOTORS FOR ARC AND INCANDESCENT CIRCUITS.

The supremacy of "THE BAXTER MOTOR" over all others has been thoroughly established, and we are now prepared to fill orders promptly. Every Motor is guaranteed. The only perfectly governed Motor in the market to-day. All sizes, from 1-16 horse power to 50 horse power.

Write for Price Lists, Testimonials and any other information.

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ALL APPLIANCES FOR THE

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COMPLETE INSTALLATIONS CONTRACTED FOR ANY CAPACITY.

NO SUB-CONTRACTORS. - NO DIVISION OF RESPONSIBILITY.

United Edison Manufacturing Company,

NEW YORK CITY.

Chicago. Denver. San Francisco. Toronto.

CHICAGO, May 19, '90.

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GENTLEMEN:

Please furnish this company 1,000,000 feet No. 14 B. & S. Braided Okonite Wire.

CHICAGO EDISON CO.,

CHAS. B. HOLMES.

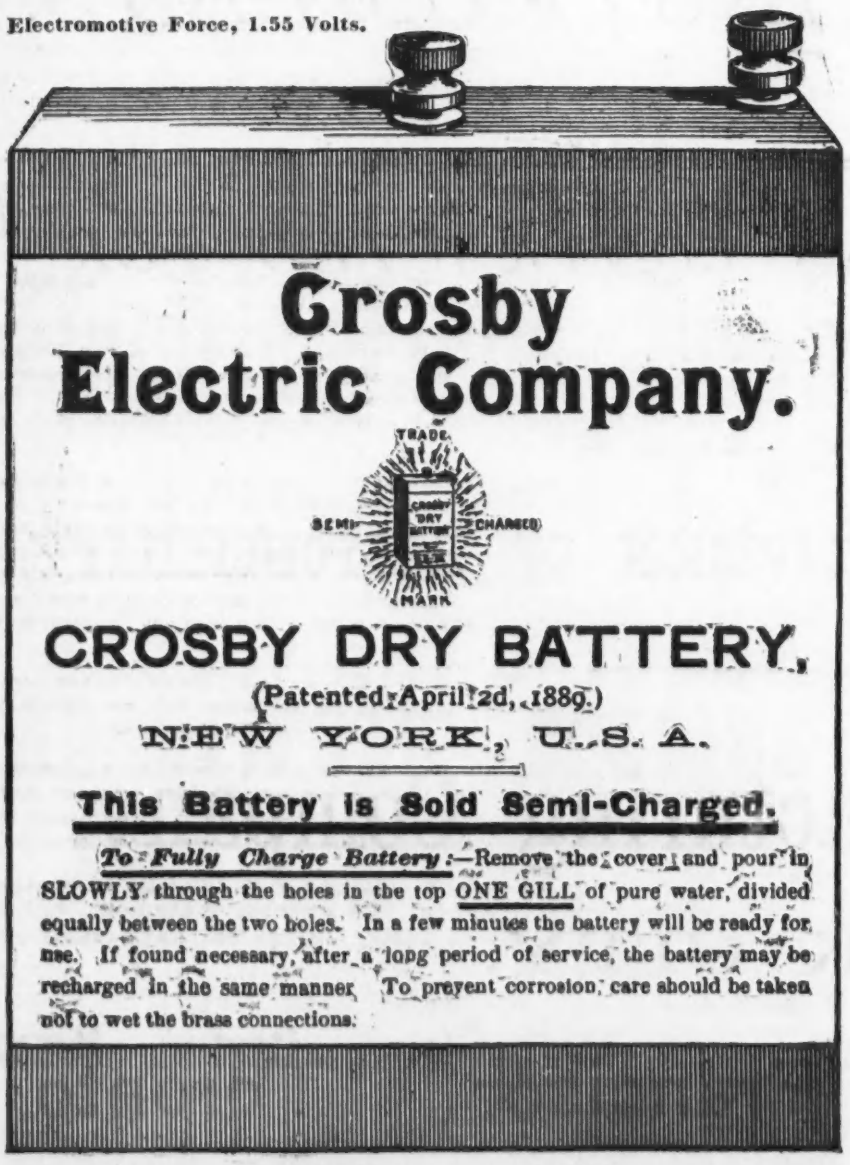
"That is What Talks."

THE CROSBY ELECTRIC COMPANY,

JUDGE BUILDING, FIFTH AVE. AND SIXTEENTH ST., NEW YORK.

CROSBY DRY BATTERIES

Electromotive Force, 1.55 Volts. **FOR OPEN CIRCUIT WORK.** **Current, 1 to 10 Amperes.**



CROSBY DRY BATTERY.

(Patented April 2d, 1889.)

NEW YORK, U. S. A.

This Battery is Sold Semi-Charged.

To Fully Charge Battery:—Remove the cover and pour in SLOWLY through the holes in the top ONE GILL of pure water, divided equally between the two holes. In a few minutes the battery will be ready for use. If found necessary, after a long period of service, the battery may be recharged in the same manner. To prevent corrosion, care should be taken not to wet the brass connections.

Advantages of the Crosby Dry Battery for Open Circuit Work.

THE CROSBY DRY BATTERY is the **best Open Circuit Battery in the market.** It possesses all the advantages claimed for any Open Circuit Battery, and is capable of performing **more work** than any other. In addition to this, it is the **most reliable, most compact, most durable** and **simplest** cell yet discovered. It is so constructed that **it is not destroyed** or seriously injured by **short circuiting,** and we are prepared to prove at any time that its **power of recuperation** is proportionately **greater** than that of any other. For Electric Bells, Gas Lighting, Burglar Alarms, Annunciators, Telephones, Microphones, Medical Electrical Purposes, Electrical Clocks and all the uses to which Open Circuit Batteries may be put, **it has no equal,** whether it be compared with **Liquid** or **other Dry Batteries.** We guarantee **depolarization, absence of offensive crystallization** and **perfect cleanliness.**

The Crosby Battery is the only Dry Battery sold **semi-charged. It does not work until wanted.**

The preference **as between Liquid and Dry Batteries** should always be given to the latter, provided the amount of working power required and a constant current can be obtained. **No form of Dry Battery** has as yet been placed before the public, **except the Crosby Dry Battery,** which will do the work of wet batteries and **give a constant supply of Electricity sufficient for reliable Open Circuit work at all times.** The advantages of a Dry Battery are obvious, because wet batteries, of whatever form, are constantly giving out offensive odors and spoiling everything with which their fumes come in contact. They are disagreeable and uncleanly machines, unsightly in appearance and easily broken and injured. **The Crosby Dry Battery** is **perfectly clean, emits no destructive gases or acids,** and, after once being properly connected, **requires no attention whatever,** while the liquid batteries are frequently in need of being cleaned, and the solution used must constantly be renewed.

The Crosby Battery is **not affected by temperature**; whether hot or cold, it is equally capable of performing the work for which it is intended.

The Crosby Dry Battery is only intended for **Open Circuit Work.** If, however, through an accident, it becomes **Short Circuited, it recoups itself.** This cannot be said with equal truth of any other dry battery known.

The Crosby Dry Batteries are manufactured in **different sizes and forms,** to suit the needs of different purchasers. The quantity of current required for any given work can be secured by a change in the form and size of the battery. For ringing bells and work of that character, the Cylindrical Batteries are to be preferred; but in instances where very low internal resistance is desired, as in telephone work and for medical electrical purposes, the Rectangular form is the better.

The quantity of current in the **Crosby Dry Batteries varies from one to ten amperes,** according to the size and shape, while the electromotive force remains constant at 1.55 volts.

[COPY.]

OFFICE OF FLEMMING'S ELECTRO-MEDICAL INSTRUMENT MANUFACTORY,
No. 1009 ARCH STREET, PHILADELPHIA, March 8, 1890.

CROSBY ELECTRIC COMPANY, NEW YORK:

GENTLEMEN: The opportunity of expressing to you my views in reference to the Dry Cells made by your firm gives me great pleasure, and I do not hesitate in describing my experience with some of them. I charged and connected one of your No. 2 square cells with one of my rapidly interrupted 4-ohm resistance primary coils, starting it Jan. 28, 1890, at 4 P. M., kept running all night and following day, Jan. 29, when at 4 P. M. it became accidentally short circuited, remaining so until 6 P. M. The cell was then released and allowed to recuperate till Jan. 30, 7:30 A.M., started again, and left running until Feb. 13, stopping during night time. Thus, in defiance of a two-hour short circuit, this cell functionated = 371 consecutive hours, a result never before attained in all my experience with open circuit battery cells. The same cell, being recharged afterwards, still retains its working capacity, apparently as good as previous to its testing. Very respectfully, (Signed) OTTO FLEMMING.

		HEIGHT.	WIDTH.	DIAM. / LENGTH.	PRICE.
CYLINDRICAL	No. 3	7¼		2½	1.20
RECTANGULAR.	No. 2	5	1½	4½	1.20
	" 3	9	1½	8	2.25
TELEPHONE.		7½	2	4½	1.50
L. D. TELEPHONE.		7½	2½	4½	2.00

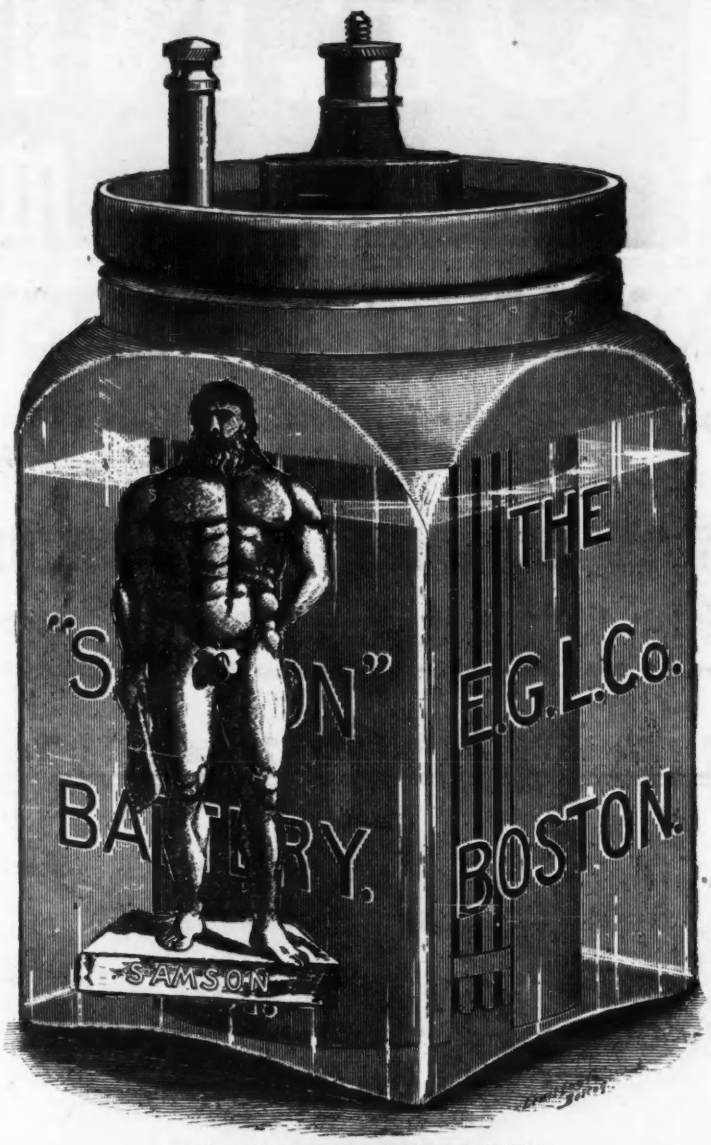
N. B.—Other Sizes and Shapes to suit Purchasers. Discount to the Trade.

"THE KING of OPEN-CIRCUIT BATTERIES."

The "SAMSON" BATTERY, like the Leclanche, came over from France, and has quickly become a Great Favorite among American Electricians and Battery Users.

Its Working Power and its Recuperative Qualities are Immense. In fact it has no Equal in Strength or Durability.

"The Best"
Always the Cheapest



The "SAMSON" is Constructed upon Common Sense Principles, and, strange to say, Imitates no other Cell!

"The Best" Open-Circuit Battery is the one which Does the Most Work and Lasts Longest with the Least Trouble and Expense.

Hundreds who Use the "SAMSON" will tell you that it fully meets all these requirements.

U. S. LETTERS PATENT PENDING.

GOOD WORDS FOR THE GREAT FRENCH BATTERY MULTIPLIED.

During the past two and a half years, OVER SIX HUNDRED PRACTICAL ELECTRICIANS have used what we originally recommended to them as

"The Best Open-Circuit Battery in the World."

WE BELIEVED WHAT WE THEN STATED, and to-day the opinions of our numerous customers overwhelmingly confirm the statement. HAVE YOU TRIED THE SAMSON BATTERY? If not, we invite you to note what scientific authorites and practical battery users are saying about it:

Prof. C. F. Brackett, of Princeton College, after thoroughly testing and examining the SAMSON Battery, in his report, among other things of a more scientific nature, says: "I have carefully measured and compared the SAMSON Battery with the Leclanché (Gonda Disque). The plotted curves (see circular) show at a glance the relative superiority of the SAMSON to the Leclanché. Careful reference to the figures and the curves which represent them will show that, where the two batteries are tested in competition, the difference in favor of the SAMSON is about 30 per cent. It is not quite as much at the end of the first hour of continuous working, but is very decidedly in favor of the SAMSON. The results of the measurements here given in detail fairly represent many others which have been made with other cells of both SAMSON and Leclanché, which have extended over a period of several weeks. In these experiments the batteries have been worked on circuits varying from 10 ohms to two ohms, and in every case the results have been decidedly in favor of the SAMSON. I have no hesitation in saying that the SAMSON Battery is the best one for open-circuit work, such as is required in household service and for telephone transmitters, with which I am acquainted."

Mr. P. L. Watson, Superintendent of Fire Department, Brooklyn, N. Y., under date of Dec. 4, 1889, says: "I would state that in 20 years' experience and use of batteries, I have never found one that could equal the SAMSON for open-circuit work. I have replaced all local and open-circuit (carbon) batteries (some 500) with it cell for cell. It has been in use in each instance over seven months, and is as good as on first day. One circuit, attached to vibrating buzzer, was left closed 27 days, constantly working the buzzer without running the battery down."

Mr. C. Lawrence, Electrical Dealer, Hamilton, O., under date of March 7, 1890 writes: "I wish to speak a good word for your SAMSON Battery. Have four cells on an electric gas lighting plant of 20 burners. Friday last plumbers were called by proprietors to make some alterations, and went away leaving *a solid short circuit on battery.* I was not called until the following Monday, when I found battery, as I supposed, ruined. It being late in the evening I cleared circuit to return in the morning to see what could be done. Imagine my surprise when I returned to find battery operating burners as usual, almost up to its normal strength! The SAMSON certainly has wonderful recuperating powers."

Prof. A. E. Dolbear, of Tufts College, the value of whose opinion will nowhere be questioned, thus writes: "I have also tested the SAMSON cells for telephone work, and find them very superior. Their small internal resistance enables them to give a stronger current through the induction coil than any Leclanché cell I have ever tested. This amounts to from 25 to 30 per cent. *The cell meets my commendation.*"

Prof. Frank M. Gilley, Instructor Science High School, Chelsea, Mass., writes us under date of May 6, 1889: "A battery to be a battery must stand frequent groundings, and great use at intervals without the necessity of substituting a new cell practically, in replacing expensive parts. The SAMSON is, therefore, in my opinion, *the only open-circuit battery in the world.* It does not require to be taken down and tinkered at irregular but frequent intervals. I do not consider that Prof. Brackett's test, as it was made on high resistance work, is sufficiently favorable to the SAMSON Battery, *even though it proved to give 30 per cent. more current than all others.* On low resistance circuits, as commonly met with in bell, burglar alarm, and electric gas-lighting work, *its output of current is at least 100 per cent. more than that of others.* Considering its great power and wonderful recuperative qualities, its substitution for other cells would practically increase the battery power of the country fourfold. Somewhat varied and tiresome trials with open-circuit batteries have at last been rewarded by finding the SAMSON."

Mr. C. M. Goddard, Electrician, Plainfield, N. J. (recently appointed Electrical Inspector for New England Exchange, of Boston), under date of Feb. 10, 1890, writes: "Allow me to say that I have now given the SAMSON Battery a trial of about three years, and I am more pleased with it than ever. I have in the last two weeks had three plants short circuited for from five to 48 hours each, and after a rest of 24 hours every cell came up to over 35 on my Warner's gauge without even cleaning and new sal ammoniac, although I replenished them after testing simply as a matter of doing a thorough job. I think they would have worked all right anyway."

Mr. W. Edw. Platt, Electrical Contractor, Augusta, Ga., writes: "I have never seen or used a battery for open-circuit work that gives the satisfaction that the SAMSON does, and all you claim as to its merits has been abundantly proven and sustained."

The Tucker Electrical Construction Co., 14 Whitehall Street, N. Y., writes: "We have used them almost entirely for the last two years, and at present have no other battery in use for similar purposes. We regard them as the best open-circuit battery we have yet been able to obtain. They have shown remarkable results for power and longevity."

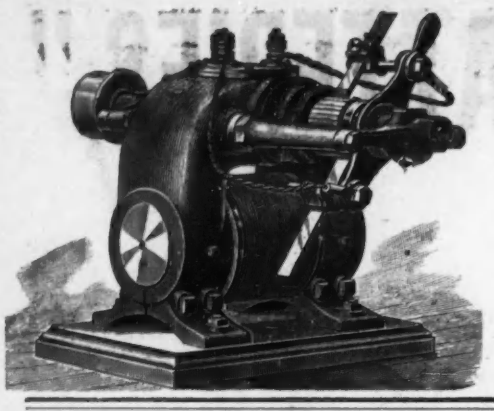
☞ **If the SAMSON Battery were substituted for all other open circuit cells, of whatever name or form now in use in the United States, the battery power of the country would be increased an average of 50 to 60 per centum! This may appear like a strong statement, but it can be substantiated by the highest scientific and practical authority in the land. There are hundreds of battery users who have tested out its truth, and who appreciate its importance.**

RESPECTFULLY,

THE ELECTRIC GAS LIGHTING CO., 195 Devonshire Street, Boston, Mass.

Sole Manufacturing Agents for the United States.

LOUIS W. BURNHAM, V.-P. and Mgr.



OUR MOTORS ARE Automatic, Highly Efficient, BEAUTIFUL RELIABLE DURABLE. FOR ARC and INCANDESCENT Circuits Self-Oiling Bearings, 1/8 to 50 H.P. Power.

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THE INTERIOR CONDUIT AND INSULATION CO.,

154 and 156 West Twenty-seventh Street, New York.

A New and Improved Method of Fitting Buildings with Insulated Tube Conduits to receive Wire for any Electrical System, combining advantages of

SAFETY, DURABILITY, ECONOMY, ACCESSIBILITY, CONVENIENCE.

Samples, Price Lists, Catalogues and Instructions Mailed on Application.

For Description of this System see "The Electrical World" of November 30, 1889.

Address THE INTERIOR CONDUIT AND INSULATION CO., 154 and 156 West Twenty-seventh Street, New York.

LIST OF DYNAMOS IN STOCK.

Designation of machine.	No. lights 2,000 c. p. 10 amp. X	No. lights 1,60 c. p. 8 amp. Y	No. lights 1,200 c. p. 6 amp. Z	No. lights 800 c. p. 4 amp.	Horse power at pulley of dynamo.	Width of single belt in inches.	Belt speed required.	Weight of dynamo.
...	.....	.....	.....	.....	.....	...		800
C	8	.....	.....	.....	6.5	1½		800
C	.....	10	.....	...	6.3	1½		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
E	.....	20	.....	.....	12.5	2½		780
E	.....	.....	26	.....	13.0	2½		780
F	20	.....	.....	.....	15.0	3		990
F	.....	25	.....	.....	15.6	3		990
F	.....	.....	32	.....	15.0	3		990
F	.....	.....	.....	50	16.0	3		990
G	28	.....	.....	...	21.0	4½	5,000 Feet per minute.	1,440

Ball Electric Light Co., 404 W. 27th St. NEW YORK

LIST OF DYNAMOS IN STOCK.

Designation of machine.	No. lights 2,000 c. p. 10 amp. X	No. lights 1,600 c. p. 8 amp. Y	No. lights 1,200 c. p. 6 amp. Z	No. lights 800 c. p. 4 amp.	Horse-power at pulley of dynamo.	Width of single belt in inches.	Belt speed required	Weight of dynamo.
G	.....	35	.....	.....	21.0	4½		1,440
G	.....	.....	45	.....	21.0	4½		1,140
G	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	.....	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,290
I	.....	.....	83	.....	38.0	8		2,290
J	64	.....	.....	.....	46.5	10		2,770
J	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12	5,000 Feet per minute.	3,200

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MANUFACTURERS OF AND DEALERS IN EVERY DESCRIPTION OF

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Electric Light and Power Plant Supplies.

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3,000 sold in one city.
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First-class in every respect.

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SIMPLEX WIRES

Positively the Best in the World.

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A cheap, first-class switch.

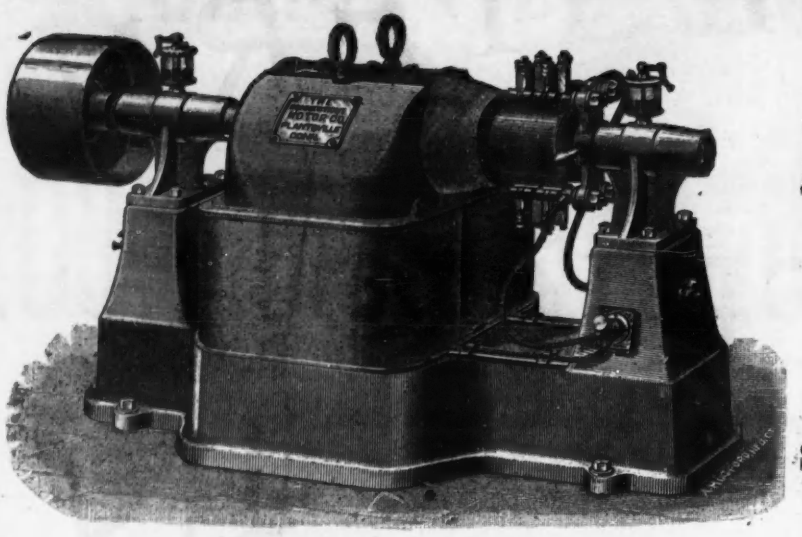
HILL'S MAIN SWITCHES.

BERNSTEIN LAMPS

For Series Incandescent Lighting.

GOOD FIGURES ON POLES.

The Connecticut Motor Co.,



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Office and Works, PLANTSVILLE, CONN.

MANUFACTURERS OF

AUTOMATIC ELECTRIC MOTORS.

All Sizes from 1-2 to 50 H. P.

Dynamos for Power or Lighting.

Workmanship and Material Unsurpassed.

SIMPLE, DURABLE, EFFICIENT.

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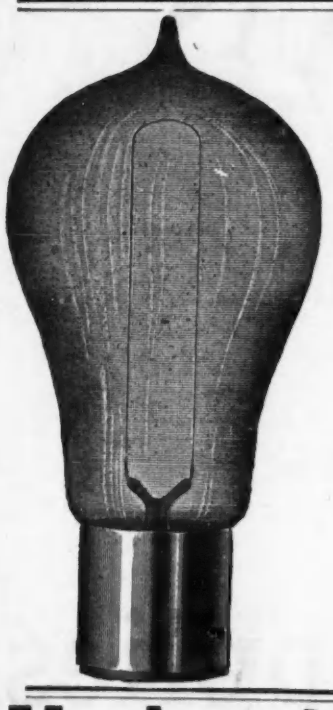

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GRIMSHAW TRADE MARK WHITE CORE INSULATED WIRE.

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Battery.

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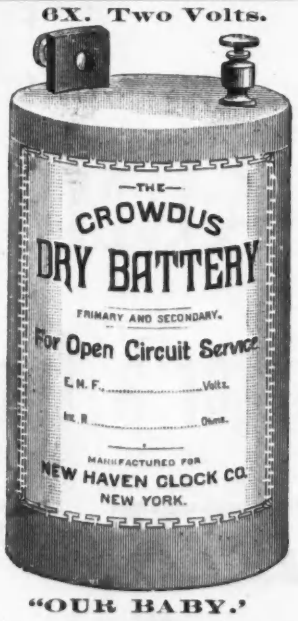
Successors to the Electrical Department New Haven Clock Co.

6X. Two Volts.



"OUR BABY."

If You Want a DRY BATTERY Use

"THE CROWDUS."

A gill of water is not necessary to operate it. Not even a drop. Connect the wires to one Cell and you have the same results as obtained from two cells of any other make.

Some Reasons Why

"THE CROWDUS"

Is the Best:

It is Absolutely Dry.
It is Not Affected by Heat.
It is Not Affected by Dampness.
One Cell will do the Work of two other makes.
The Testimonials which accompany our Circular say it is the Best.
Try a Cell and you will Appreciate it also.

Send for our General Catalogue of Electrical Supplies, Telegraph Instruments, Call Boxes, Annunciators, Bells, Wire, etc., etc. Illustrated in colors. Sent free to any address.

Our 6X

Is equal to two cells of ordinary battery E. M. F. Two volts. Int. resist., 25 ohms. This Battery is Absolutely Dry. Lever Creeps Over and will Stand Heat or Cold. It is an exceptional Battery for Telephone Work.

Price, - - - $1.25

"OUR BABY."

The Smallest Battery ever made. E. M. F., two volts. It is a wonder to every one. Cut full size. Equals two cells of ordinary battery.

Price, - - - 50 cents.

OUR MEDICAL BATTERY.

E. M. F., four volts. Int. resist., three ohms.

Price - - $2.00

WANTED.

DYNAMO AND LAMP MAN WANTED.—Must be temperate and energetic; steady employment and increase of pay as business grows. Address X., care THE ELECTRICAL WORLD, New York.

GLASS BLOWER WANTED.—EXPERIENCED glass blower who can make stop cocks and any glass piece from drawing or sample. Address, giving experience, references, present employment and wages expected, T.-H. ELECTRIC CO., Lynn, Mass.

THOROUGH ELECTRICIAN.—A MAN WHO IS a thorough Electrician, understands the business and is willing to work, can hear of a good situation by addressing R. A. E., care THE ELECTRICAL WORLD, New York.

GENERAL AGENT WANTED FOR NORTH America by one of the largest manufacturers of charcoal pencils. Applicants who are willing to keep an assortment on own account will be preferred. Offers, with references, to be addressed to F. 967, care of Rudolf Mosse, Nurnberg, Germany.

SITUATION WANTED.—MECHANICAL AND Electrical Engineer, expert in electric lighting and transmission of power, is open for an engagement. Can furnish first-class reference. Speaks French only. Address M. C., care THE ELECTRICAL WORLD, New York.

SITUATION WANTED.—A SUPERINTENDENT and an Electrician wants a situation with some responsible electrical company. Is capable of installing an electrical railway or light plant from survey stakes to schedule time-card. Address S. E., care THE ELECTRICAL WORLD, New York.

SITUATION WANTED.—YOUNG MAN HAVing a good theoretical and excellent practical experience in storage battery and electric traction work, desires a position of some trust with chance of advancement. Excellent references as to character and ability. Address TRACTION, care THE ELECTRICAL WORLD, New York.

MANAGER FOR ELECTRIC LIGHT PLANT.—A competent electrician with a little capital, to become interested and take charge of a storage electric light plant, now running over 400 incandescent lights. A good manager can increase this 200 lights. Town negotiating for arc lighting; company on a paying basis. Address R. C. BELVILLE, Room 817, Girard Building, Philadelphia.

SUPERINTENDENT WANTED.—WHO WILL invest about $3,000 in stock, to take the entire management of the best arc and incandescent electric light plant of its size in Michigan. Plant new, paying good dividends; good contract with city; only plant in place of 5,000 inhabitants. Must have good references. Address P. T. S., care THE ELECTRICAL WORLD, 465 The Rookery, Chicago, Ill.

SEALED PROPOSALS.

Treasury Department, office of the Secretary, Washington, D. C., June 6, 1890.—Sealed proposals will be received at this department until two (2) o'clock P. M., Saturday, June 28, 1890, for furnishing electrical supplies required during the fiscal year ending June 30, 1891, for U. S. buildings at Philadelphia, Pa.; Cincinnati, O.; Boston, Mass.; Pittsburgh, Pa.; Chicago, Ill., St. Louis, Mo.; Kansas City, Mo., and New Orleans, La. Instructions to bidders will be furnished upon application. Separate detailed proposals, stating the price per unit of quantity, for all supplies incident to the maintenance of the electric light plants operated in U. S. buildings in the cities above named, to be submitted. The department reserves the right to two annual renewals of accepted proposals, and to reject any or all bids or parts of bids, and to waive defects. Proposals must be addressed to the Secretary of the Treasury, Washington, D. C., and marked "Proposals for Electrical Supplies." W. Windom, Secretary.

C. M. BLANCHARD.
ELECTRICAL CONTRACTOR & ENGINEER.
Girard Building, Broad & Chestnut Sts.
PHILADELPHIA.

ALUMINUM, $2 PER POUND.

The Pittsburgh Reduction Company, 95 Fifth avenue, Pittsburgh, Pa., U. S. A., offer commercially pure aluminum at the following rates at Pittsburgh, Pa.:

Lots of 1,000 lbs. and over....$2.00 ₱ lb.
Lots of 500 lbs. and over.....2.25 ₱ lb.
Lots of 100 lbs. and over.....2.50 ₱ lb.

Metal guaranteed to be equal in quality to the best metal manufactured by any other process.
Prices on sheets, wire, tubes or castings given upon application.

Telephone Companies,
Supply Houses,
Bell Hangers,
Physicians
AND ALL USERS OF
OPEN CIRCUIT
BATTERIES,
are invited to write the
LAW TELEPHONE CO.,
85 John St. New York,
Who have something of interest for them.

STEVENS PATENT SPRING CALIPERS
Leader, No. 70. Price, by mail, postpaid.
2½ inch, $0.65 | 4 inch, $0.75 | 6 inch, $0.85
3 " 0.70 | 5 " 0.80 | 8 " 1.00
All those supplied with Ideal Nut costing 25c. additional.
Ideal and Leader Spring Dividers and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ Illustrated catalogue free to all.
J. STEVENS ARMS & TOOL CO.
P. O. Box 237 Chicopee Falls, Mass.

R. D. WILSON & CO.,
Promoters and Dealers in
Electric Securities
EXCLUSIVELY,
Offer a limited number of shares of the Treasury Stock of the
New England Printing Telegraph Co.
Capital, $1,500,000. Par Value, $50.
PRESIDENT:
FRANK B. DOLE, BOSTON.
DIRECTORS:
Frank B. Dole, James P. Cook, Boston; Geo. W. Slade, Fall River; Abner McKinley, Canton, O.; P. S. Jennings, New York. John R. Reed, Westfield, Mass.
This company is the licensee of the Essick Printing Telegraph System for the New England States.
The office of the parent company is at 171 Broadway, New York, where the system may be seen in operation on a line to Boston.
Correspondence Solicited.
Further information furnished, and an exhibition of the system may be seen at
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CLARK
ARC SYSTEM
Is the Cheapest and Most Economical in the United States.
Manufactured by The CLARK ELECTRIC CO., 192 Broadway, New York.

The SUNBEAM Incandescent Lamp Maintains its Rated
CANDLE-POWER.
SEND FOR PRICE-LIST.
The Sunbeam Incandescent Lamp Co., cor. Randolph & Canal Sts., Chicago.

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FOR SHORT PRIVATE LINES.
NATIONAL TELEPHONE MFG. CO., 620 ATLANTIC AVE., BOSTON, MASS.

The Illinois Electric Material Company.
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POLES.
Bishop RUBBER-COVERED Wires.
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Switches, K. W. Cut-Outs, Rosettes, etc.
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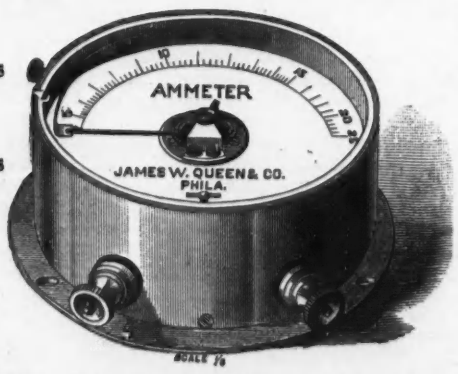
For Direct and Alternating Currents.
Queen's Standard Resistance Boxes and Wheatstone Bridges wound with Platinoid Wire. Magnetic Vane Ammeter.


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We have Special Facilities for Recalibrating Ammeters and Voltmeters.
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QUEEN & CO., Philadelphia.

THE "CLARK" WIRE.
Insulation Guaranteed wherever Used, Aerial, Underground or Submarine.

In a letter from the INSPECTOR of the Boston Fire Underwriters' Union, under date of March 29, 1886, he says: "A Thoroughly Reliable and Desirable Wire in every respect."
The rubber used in insulating our wires and cables is especially chemically prepared, and *is guaranteed to be waterproof*, and *will not deteriorate, oxidize* or *crack*, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, which is water, oil, acid, and to a very great extent fireproof. *Our insulation will prove durable when all others fail.* We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order.
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CLARK JOINT GUM should be used for making water-proof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass.
FOR RAILWAY AND MOTOR use, we make all sizes of stranded and flexible cables with Clark insulation. Wire Tables and price list will be furnished on application to
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POLES.—ABOUT 200 CHESTNUT POLES, 30 ft. long, 6 in. and 7 in. tops, extra straight and sound and well seasoned. Located near Jamaica, L. I., by a side track, ready for loading on cars. Will sell cheap. WOODBRIDGE & TURNER, 74 Cortlandt street, New York City.

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One 50-light American dynamo, with regulator, and 50 single American lamps.
One 35-light American dynamo, with 35 Fuller-Wood single lamps.
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One spare armature for 20-light American dynamo.
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One 10-light Excelsior dynamo with 10 single lamps.
One 6-light Van Depoele dynamo, low tension, with six single lamps.

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One 700-light shunt wound dynamo, 100 volts, 37 ampères.
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Two 300-light U. S. shunt wound dynamos 70 volts.
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Two 25-light Excelsior armatures, new.
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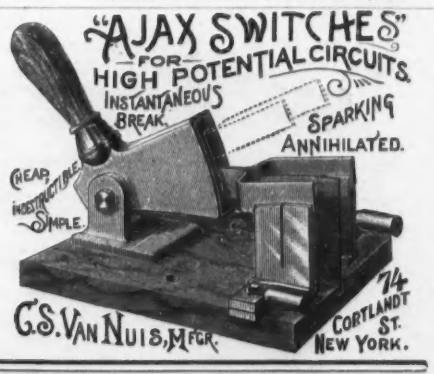

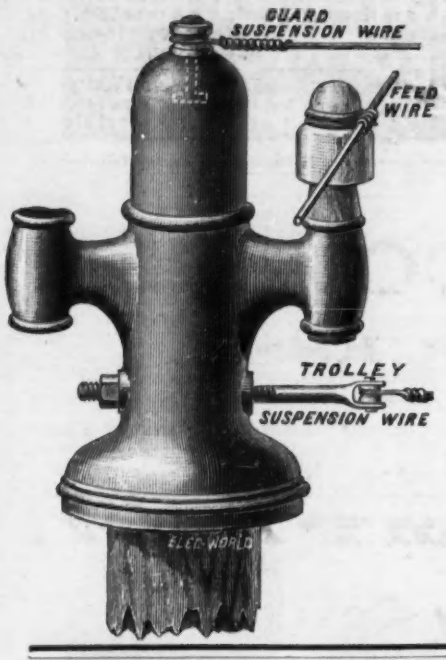

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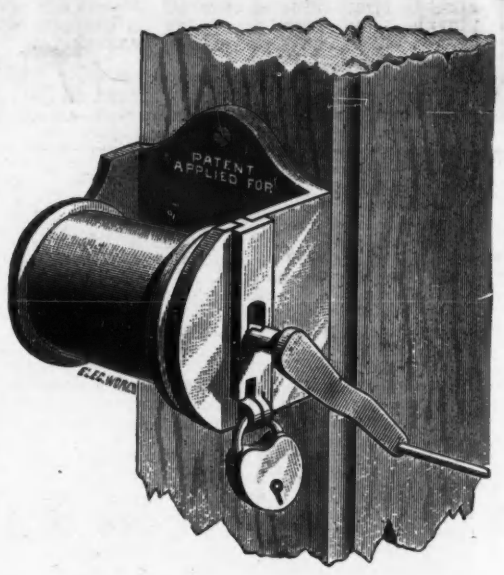

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Cross Compound.
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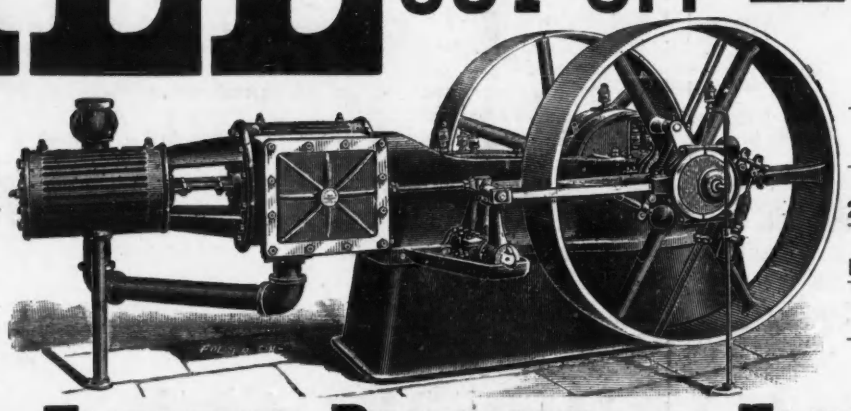

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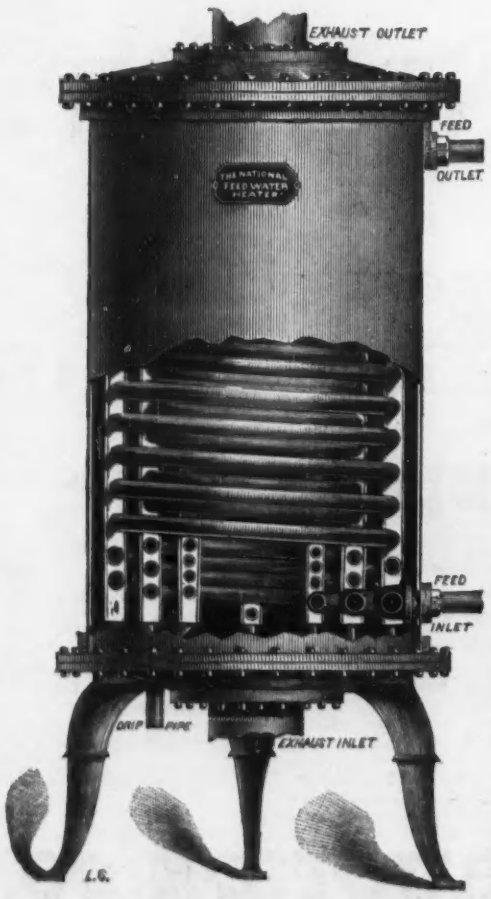

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Consolidated Electric Light Co	Portland, Me.	500
Bangor " "	Bangor, Me.	200
Bar Harbor " "	Bar Harbor, Me.	200
Dover " "	Dover, N. H.	200
Cambridge " "	Cambridge, Mass.	700
Boston " "	Boston, Mass.	600
Edison " "	"	2000
Brush " "	"	1000
West End Street R. R.	"	1000
Suburban Electric Light Co.	Brookline, Mass.	200
Edison " "	Brockton, Mass	150
Essex " "	Essex, Mass.	200
East Boston " "	East Boston, Mass.	200
Edison " "	New Bedford, Mass.	300
New Bedford " "	" "	300
Lynn Gas Light Co.	Lynn, Mass.	1000
Thomson Electric Welding Co.	"	500
Springfield Electric Light Co.	Springfield, Mass	500
Newport " "	Newport, R. I.	200
Narragansett Pier Electric Light Co.	Narragansett, R. I.	300
Edison Illuminating Co.	Newport, R. I.	300
New Haven Electric Light Co.	New Haven, Conn.	1000
Bridgeport " "	Bridgeport, Conn	900
Norwich " "	Norwich, Conn.	200
Connecticut Illuminating Co.	Waterbury, Conn	300
Meriden Electric Light Co	Meriden, Conn.	200
Binghamton "	Binghamton, N. Y.	150
Edison "	Newburg, N. Y.	200
United States Illuminating Co.	New York, N. Y.	500
Poughkeepsie Electric Light Co.	Poughkeepsie, N. Y.	300
Edison " "	Rochester, N. Y.	800
American " "	Saratoga, N. Y.	200
Post-Office Electric Light Plant.	New York, N. Y.	150
Sprague Electric R. R. Co.	Albany, N. Y.	500
East River Electric Co.	New York	1000
Auburn "	Auburn, N. Y.	500

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Westinghouse Illuminating Co.	Saratoga, N. Y.	500
Atlantic City Electric Light Co.	Atlantic City, N. J.	300
Camden " "	Camden, N. J.	150
Camden E. R. R. Co.	"	300
Thomson-Houston Electric Light Co.	Long Branch, N. J.	200
" " "	Newark, N. J.	200
Plainfield " "	Plainfield, N. J.	300
Trenton " "	Trenton, N. J.	300
Thomson-Houston " "	Hoboken, N. J.	200
Schuyler " "	Elizabeth, N. J.	300
Edison Electric Illuminating Co.	Easton, Pa.	600
McKeesport Electric Light Co.	McKeesport, Pa.	300
Electric Light and Power Co.	Carbondale, Pa.	100
" "	Columbia, Pa.	100
Pittsburgh Electric Light Co.	Pittsburgh, Pa.	600
South Side " "	"	300
Westinghouse " "	"	500
Citizens' " "	Shenandoah, Pa.	100
Easton " "	Easton, Md.	150
Waterhouse Electric Co.	Baltimore, Md.	500
International Construction Co.	"	500
Sprague Electric Railway	Richmond, Va.	500
Parkersburg Electric Light Co.	Parkersburg, W. Va.	200
Charlotte Electric Light Co.	Charlotte, N. C.	600
Thomson-Houston Electric Co.	Atlanta, Ga.	500
Brush Electric Light Co.	Savannah, Ga	200
Mobile " "	Mobile, Ala.	100
Birmingham Electric Light Co	Birmingham, Ala	400
Nashville Electric Light and Power Co	Nashville, Tenn.	300
Ann Arbor Electric Light Co	Ann Arbor, Mich	200
Edison Illuminating Co.	Detroit, Mich.	1600
Electric Light Co.	Grand Rapids, Mich.	800
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Excelsior Electric Light Co.	Port Huron, Mich.	300
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We make a specialty of re-covering old wires of any manufacture, putting on a covering **not braided,** but **WOVEN,** like canvas, and unequalled for tensile strength, abrasion and insulation resistance. and thoroughly fire-proof, at a saving of many dollars per mile.

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ELECTRICAL SAFETY COMPANY.

MANUFACTURERS AND LICENSORS OF THE

Cartwright Electrical Protectors and other Safety Devices.

The Only Protector which has received the UNQUALIFIED Official Approval of the Boston Board of Fire Underwriters.

BOSTON BOARD OF FIRE UNDERWRITERS, 55 Kilby St., Room 63, BOSTON, April 21, 1890.

Electrical Safety Company, H. E. Townsend, Esq., Treasurer:

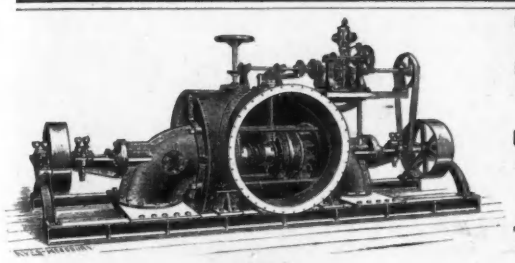
DEAR SIR: In reply to your favor of this date, permit me to say that the Cartwright Electrical Protector submitted by your company at the recent test of Electrical Safety Devices made by the Boston Fire Underwriters' Union is reported to us as having met in a satisfactory manner all the conditions of the test, and the use of the said Protector will be approved by our Inspectors.

I am, yours truly,

(Signed) OSBORNE HOWES, JR., Secretary.

Liberal arrangements made with responsible parties desiring to form sub-companies for specified territory.

146 Franklin Street, Boston, Mass., Room 21.



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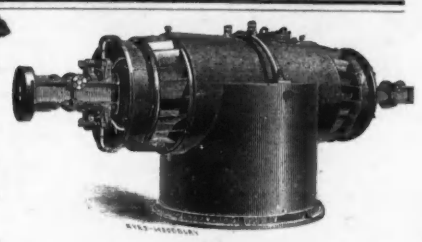

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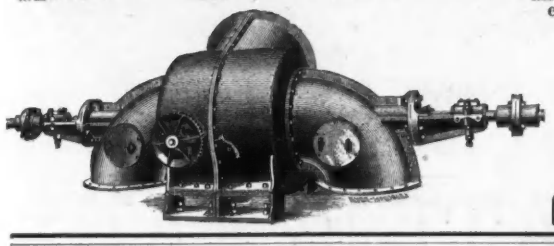

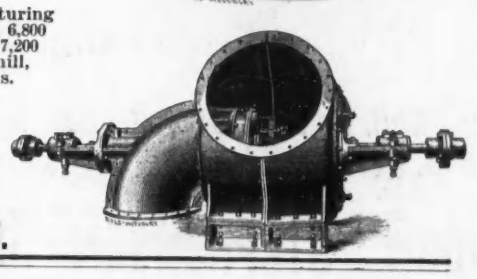

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THE PERKINS INCANDESCENT LAMP.

Highest Efficiency.

Any Candle Power.

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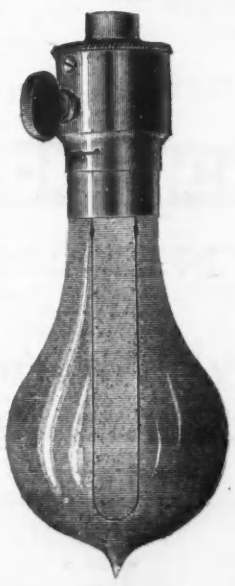

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Non-Blackening.

Any System.

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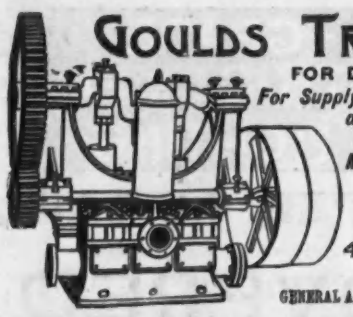

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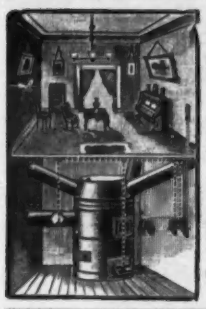

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Saves coal, saves doctors' bills, saves labor.

Automatic, simple and durable. Insures UNIFORM temperature throughout the house. No heater complete without it. Can be applied to ANY KIND of heating apparatus Try one and be convinced. If not sold in your town, write us for illustrated circular and prices.

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Plain and Covered Mouth-pieces, Flexible Tubing, Improved Stamped Speaking Tube Elbows, Etc.

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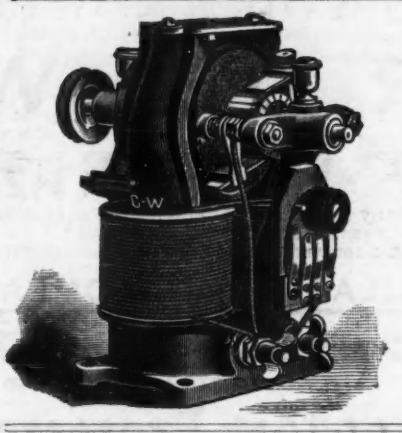

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PERFECTED MOTORS

Develop Full Power at Half the Spee of other Makes and are Noiseless

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Our facilities for laying up and armoring cables for aerial, underground and submarine uses are unequaled in the United States.

The attention of **Telephone Managers** is especially asked to our **Anti-Induction** Telephone Cables, they being the most practicable and durable in the market.

Telephone, Telegraph and Electric Light Wires for either submarine or underground work a specialty. Estimates for complete systems of underground wires and conduits will be furnished on application.

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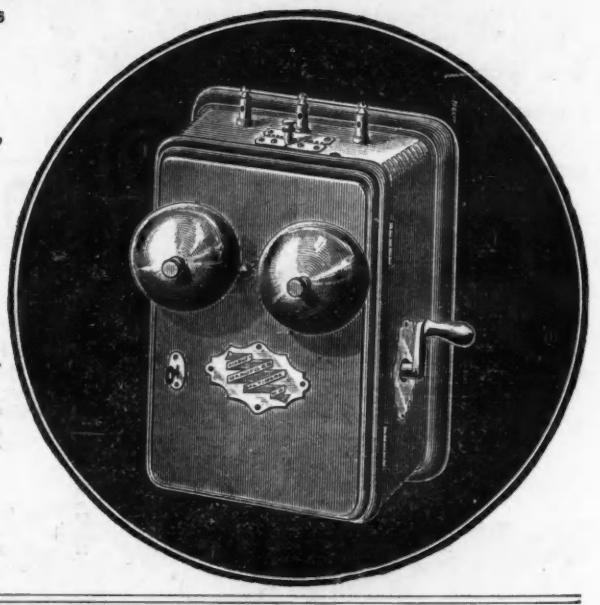

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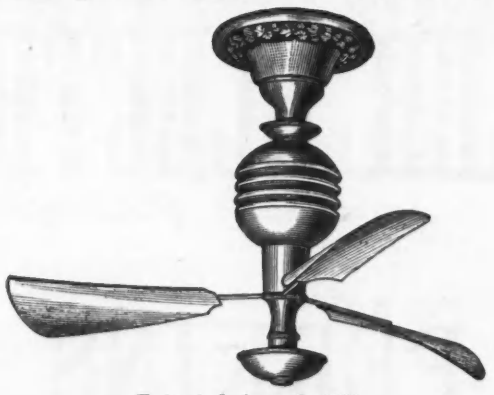

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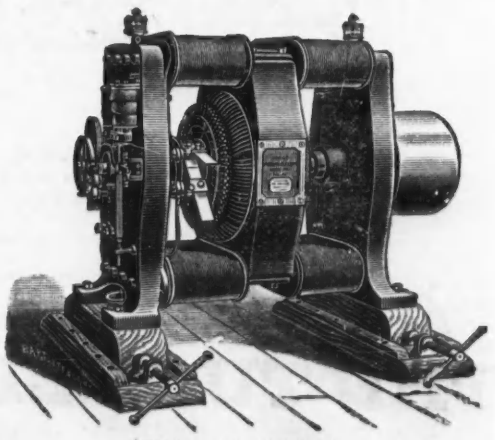

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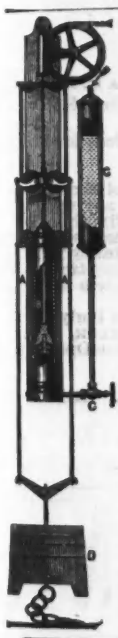

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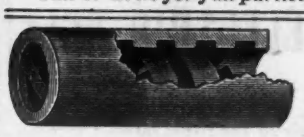

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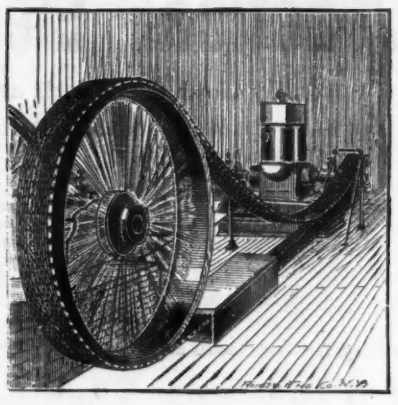

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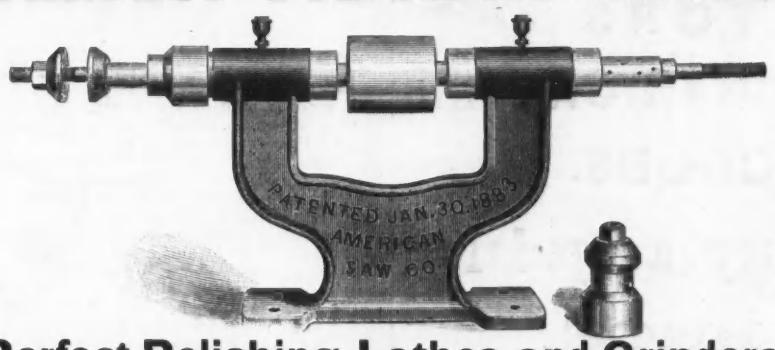

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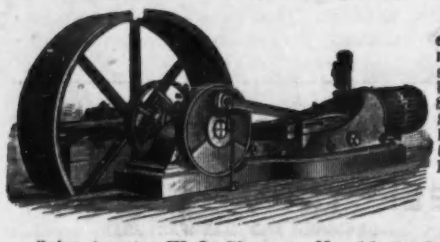

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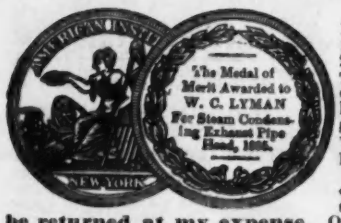

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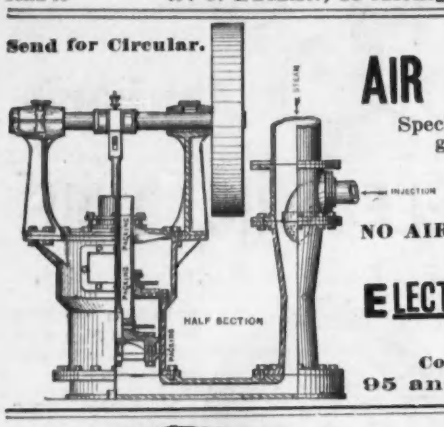

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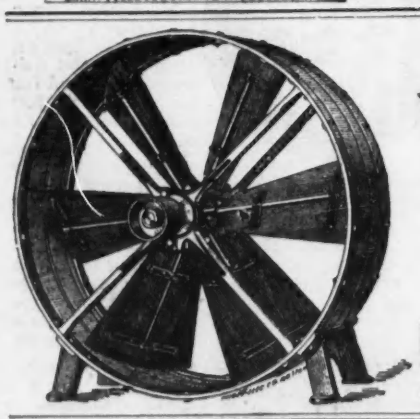

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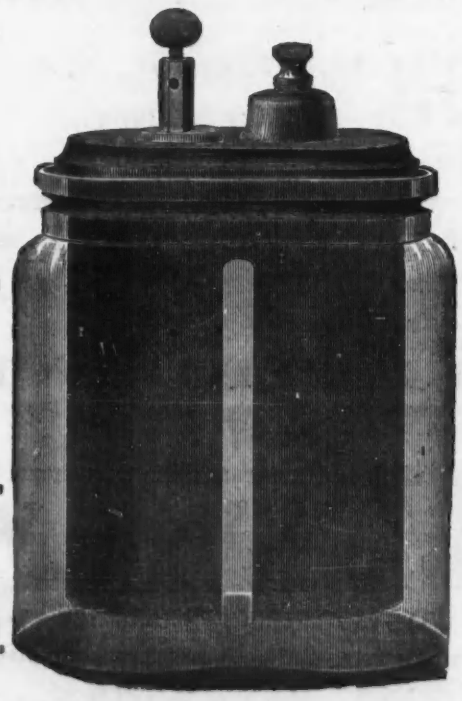

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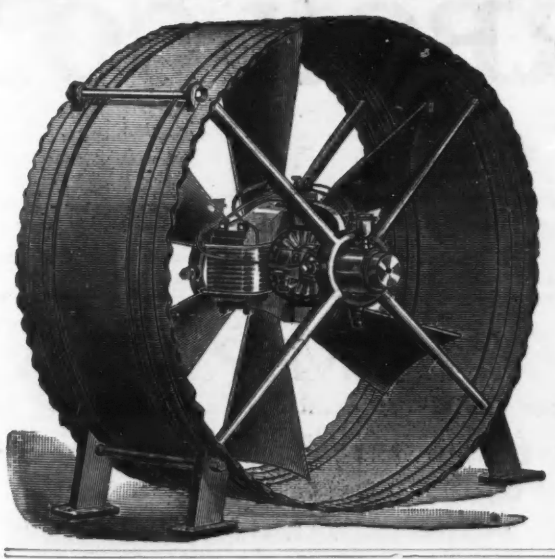

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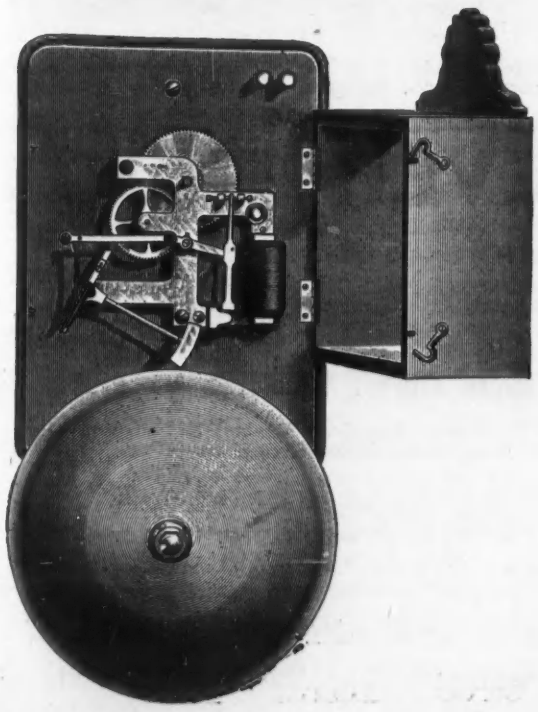

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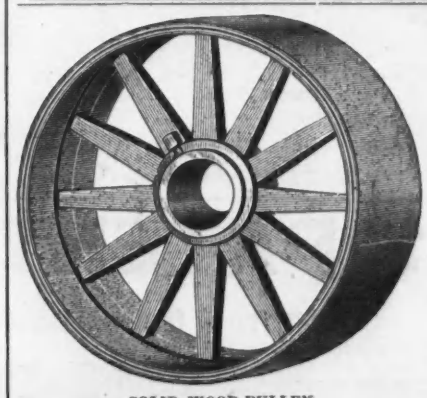

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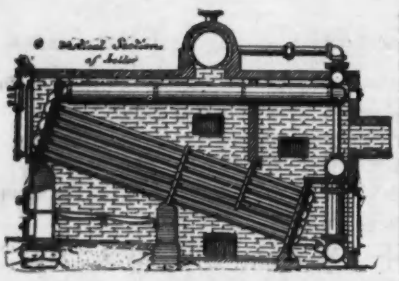

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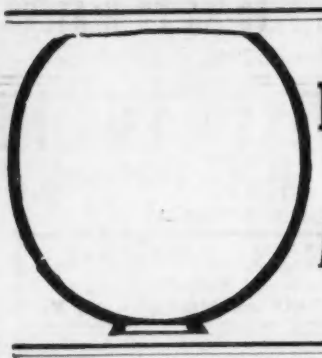

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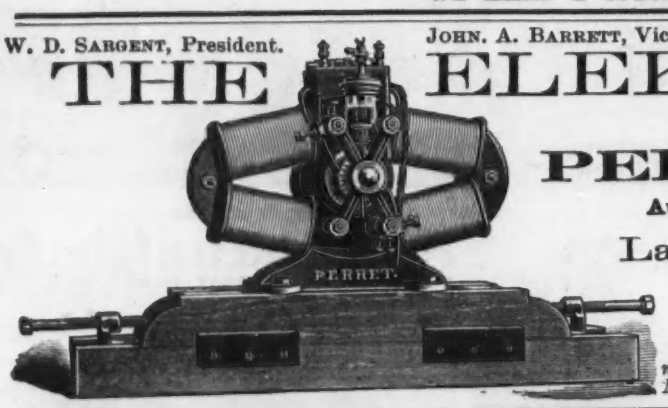

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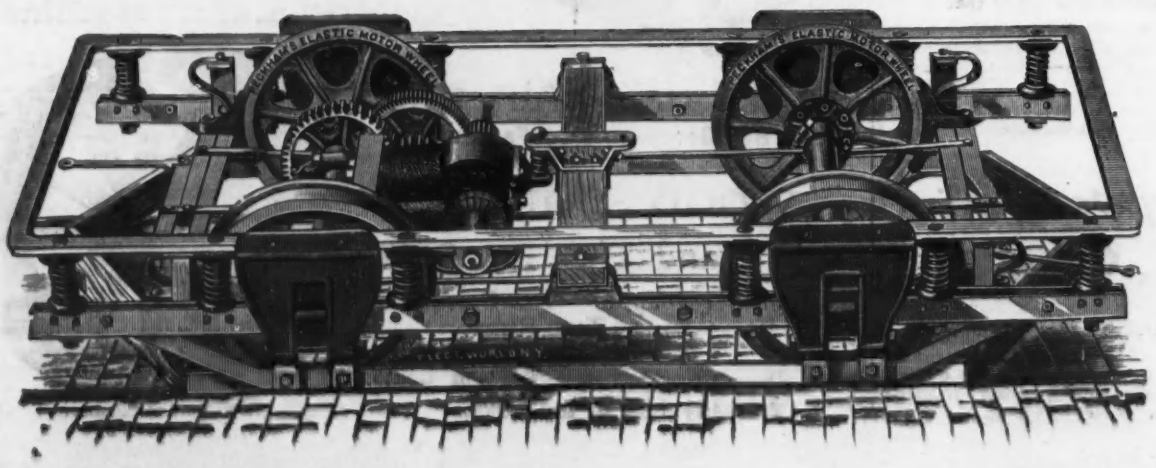

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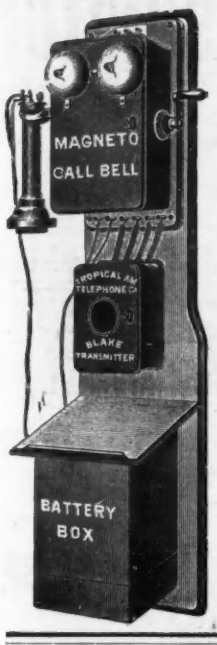

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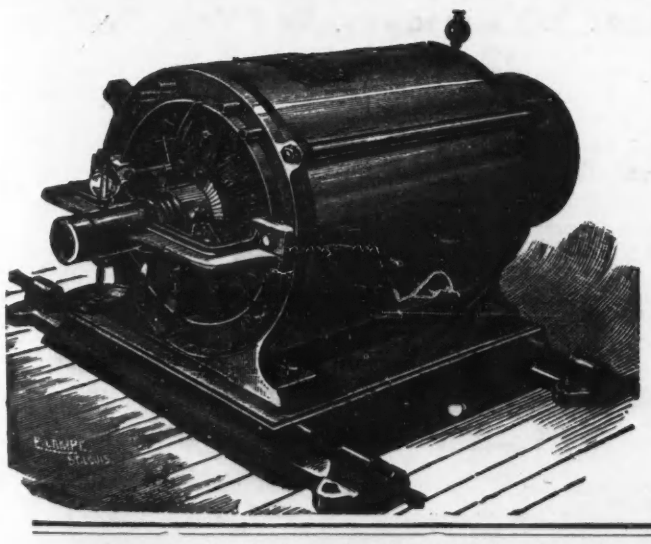

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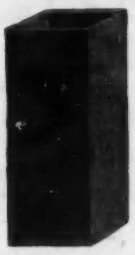

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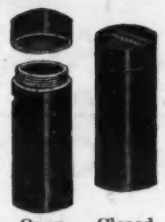

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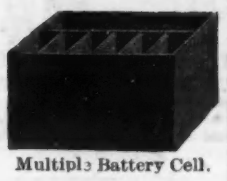

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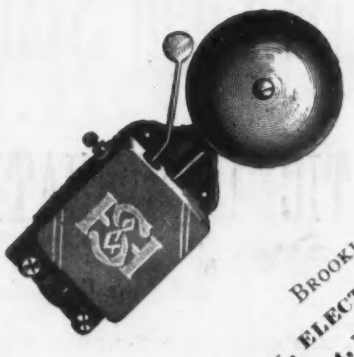

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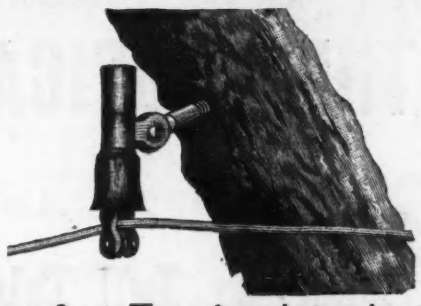

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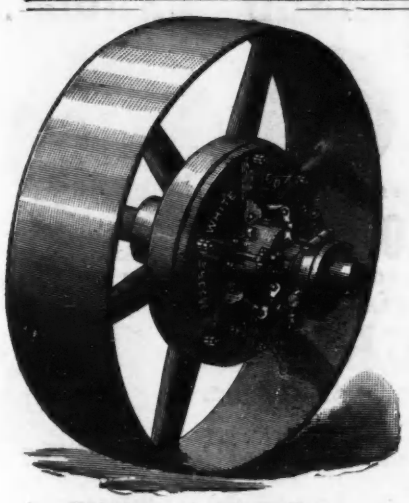

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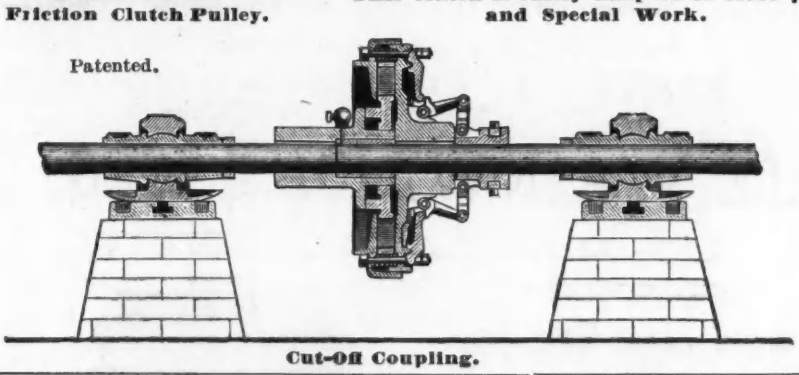

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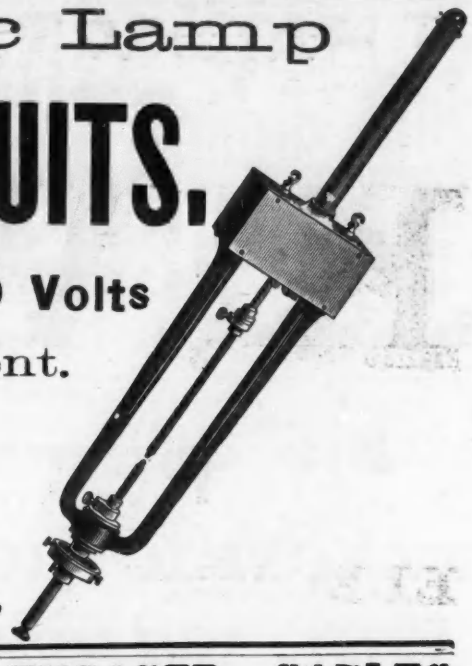

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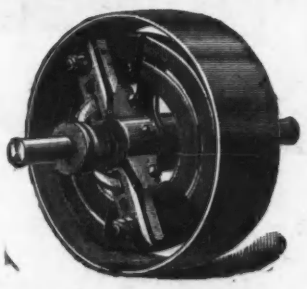

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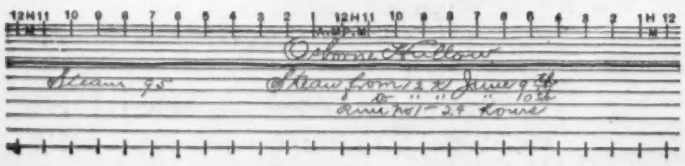

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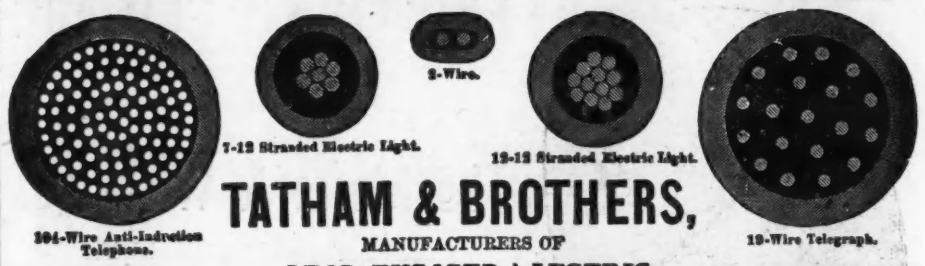

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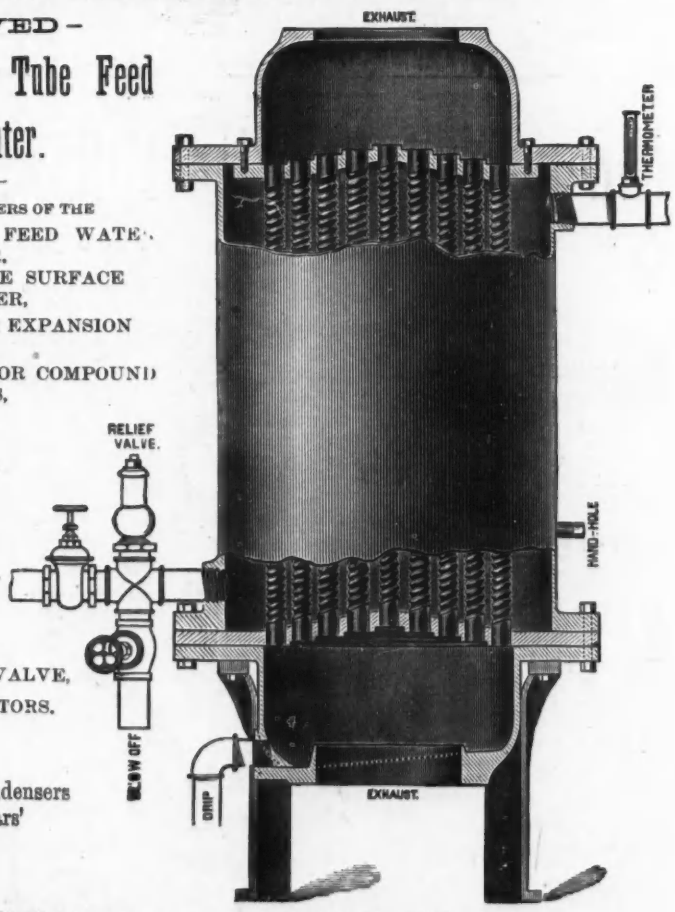

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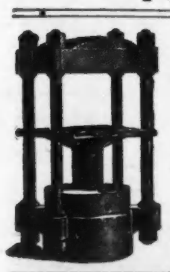

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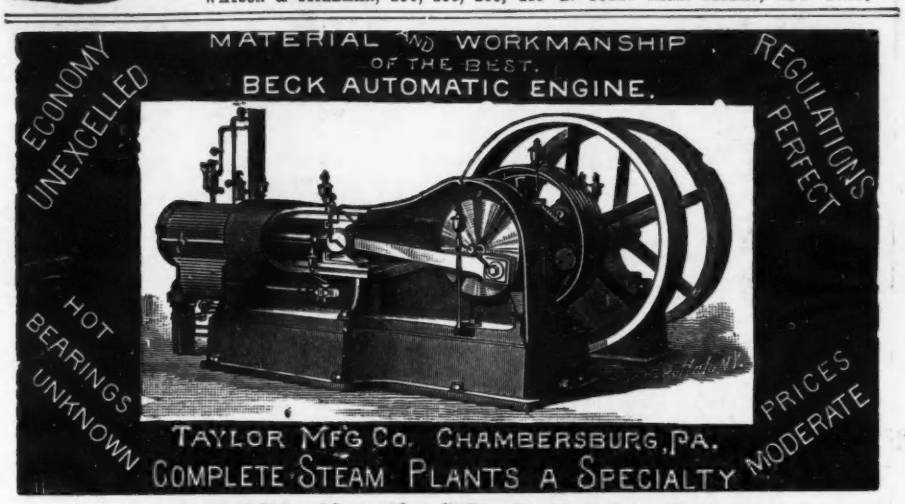

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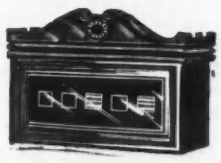

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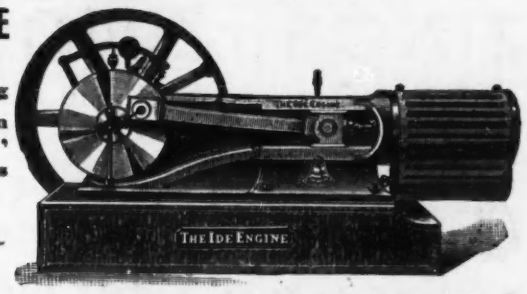

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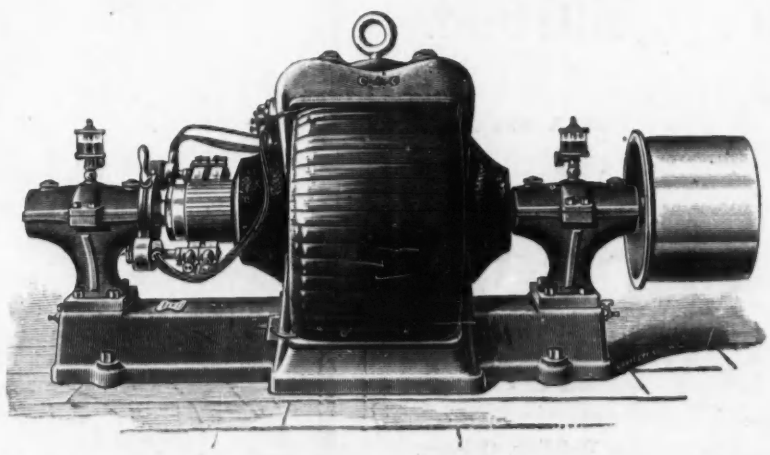

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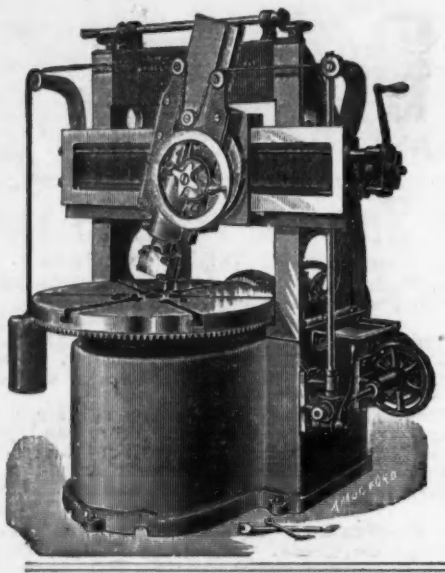

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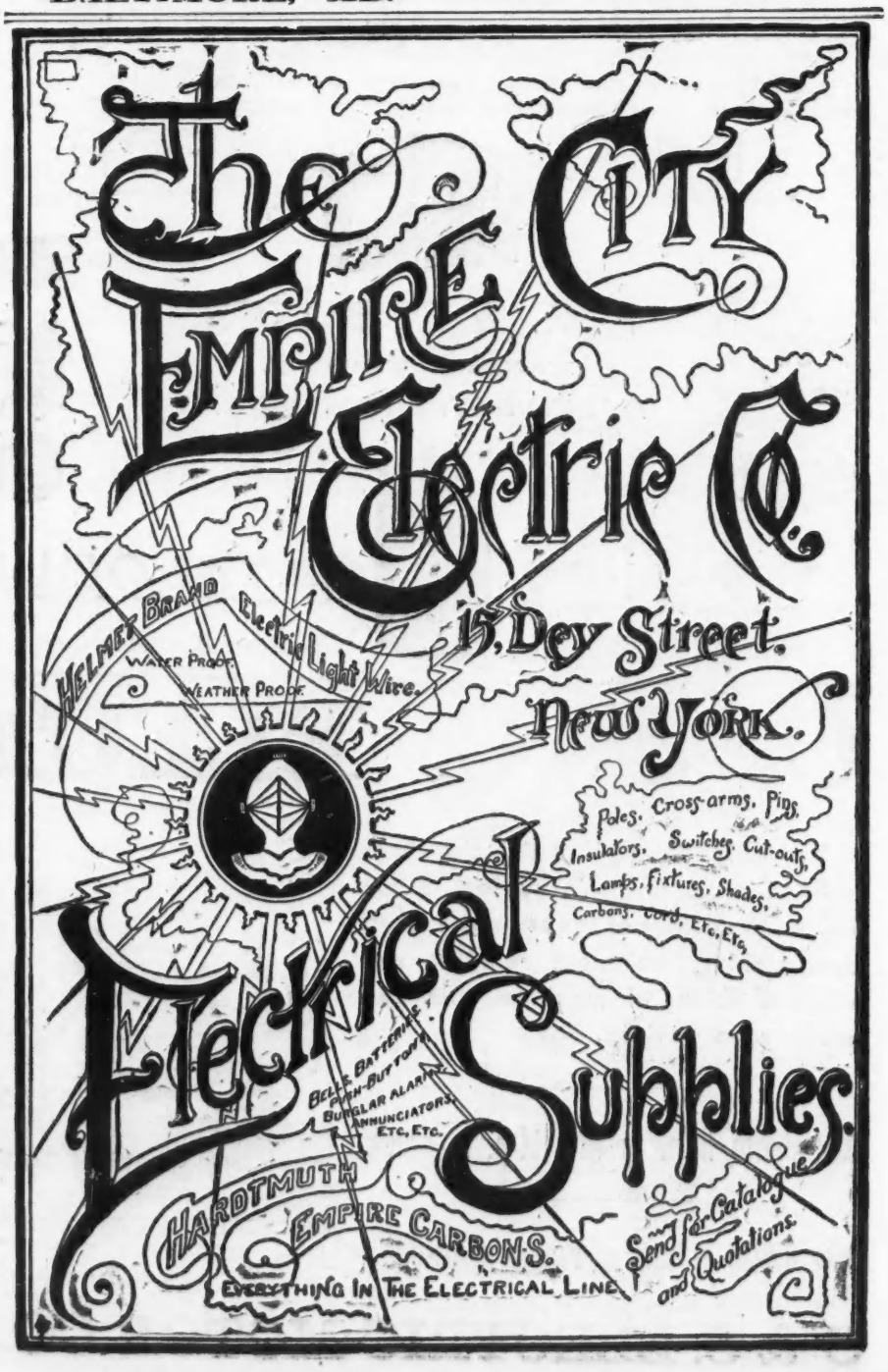

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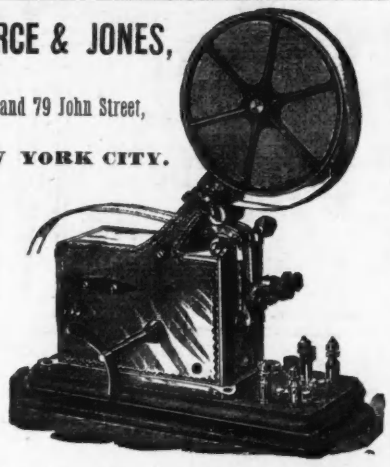

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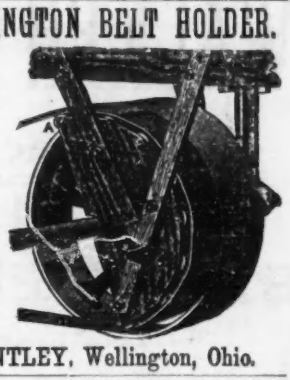

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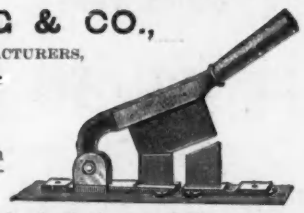

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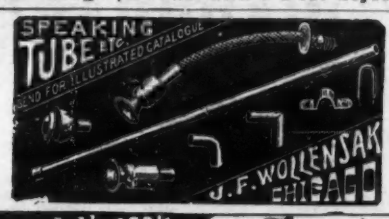

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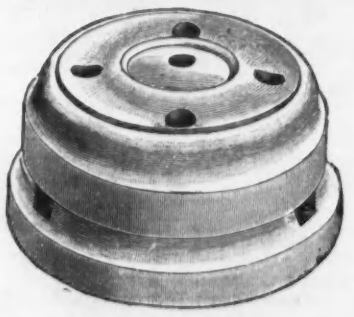

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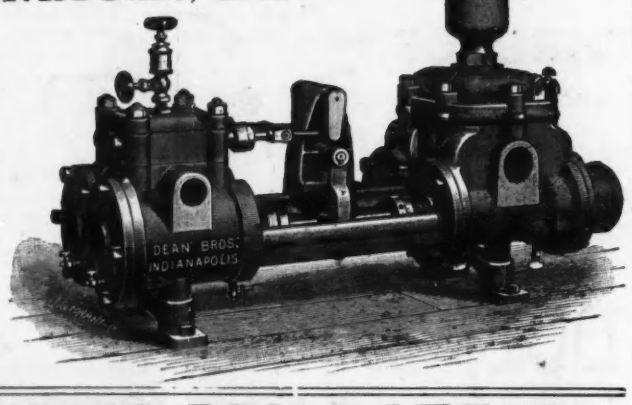

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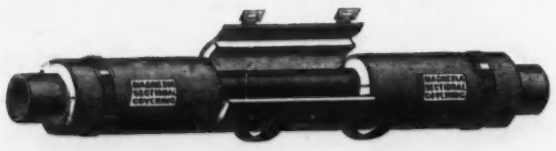

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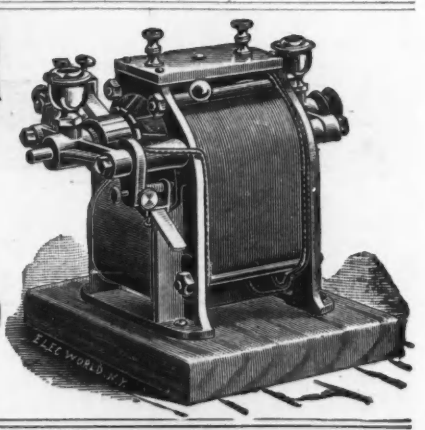

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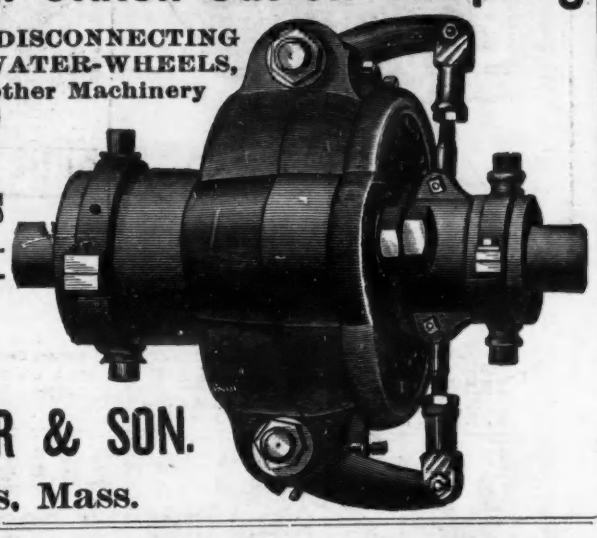

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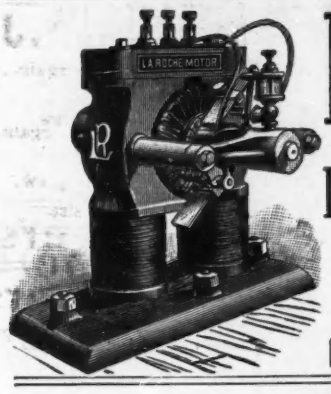

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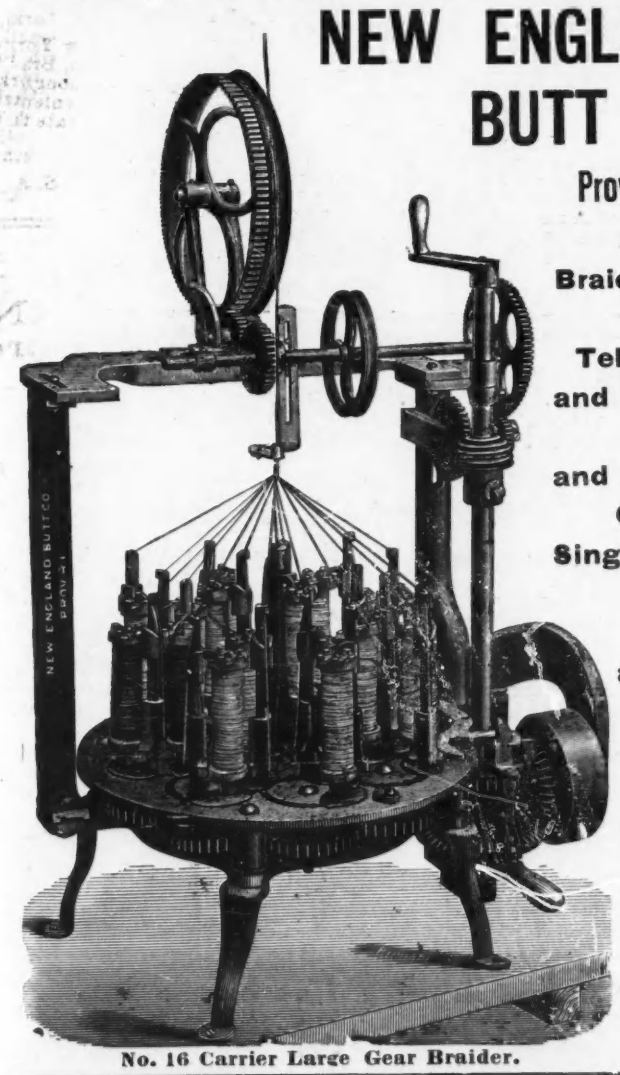

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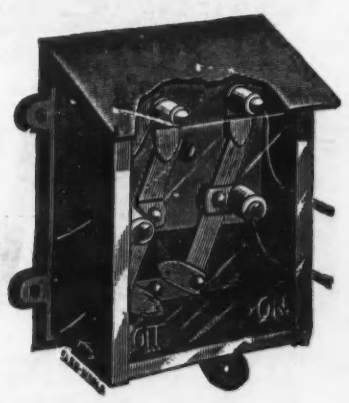

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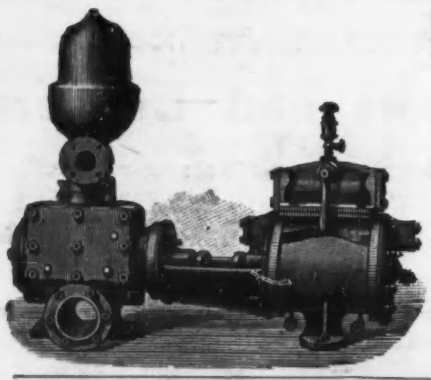

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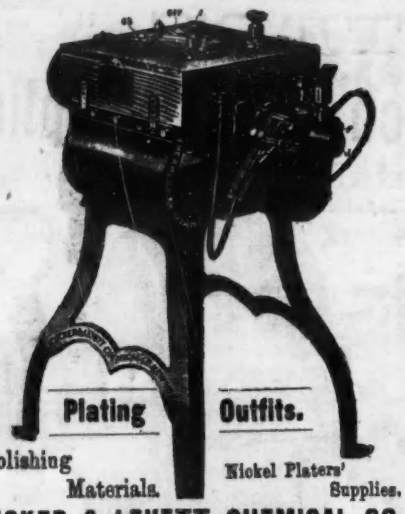

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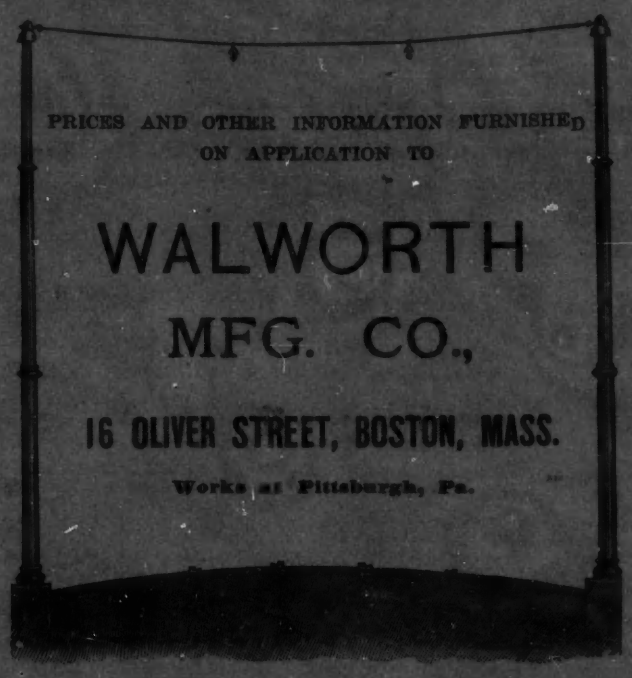

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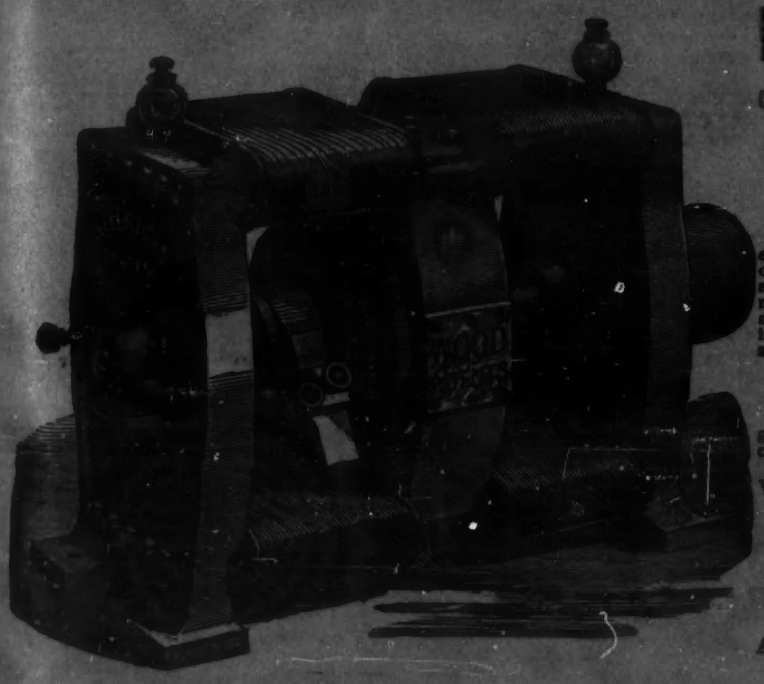

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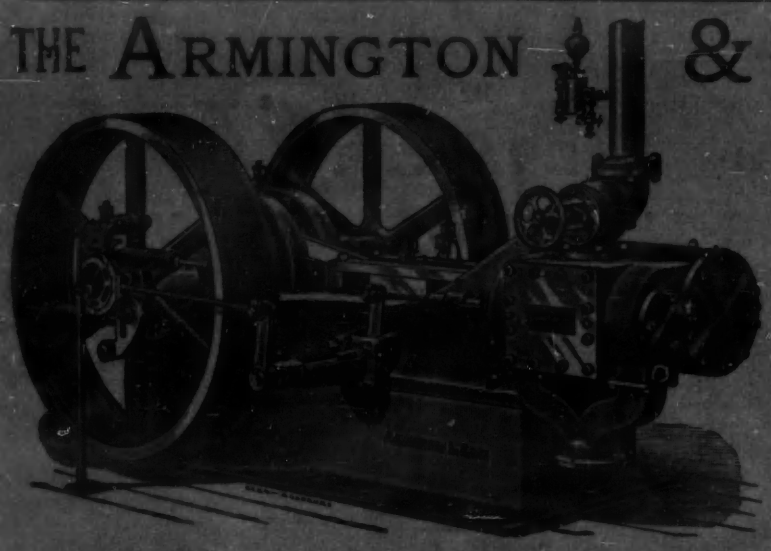

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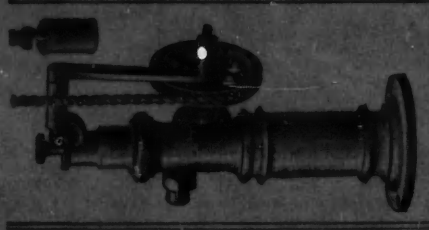

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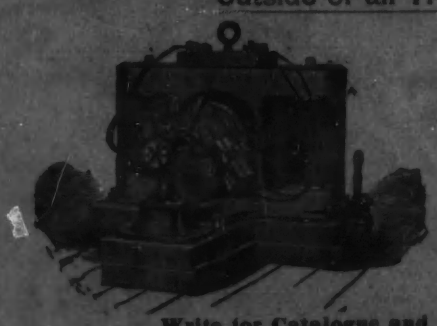

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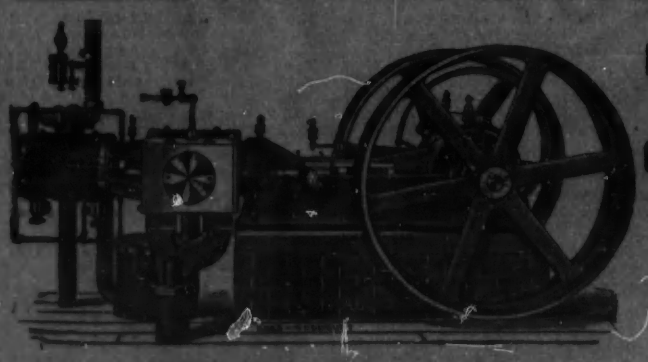

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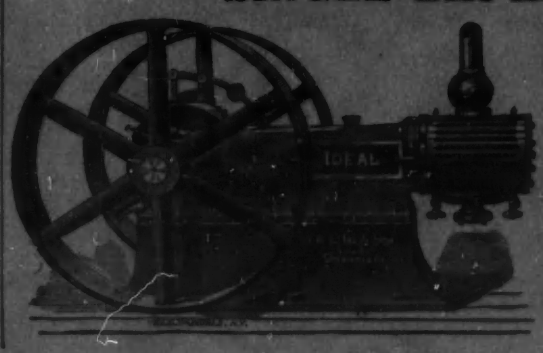

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